BLM LIBRARY
88007405

APRIL, 1969

VEGETATION AND SOILS OF THE PINE AND MATHEWS CANYON WATERSHEDS

WILBERT H. BLACKBURN PAUL T. TUELLER RICHARD E. ECKERT, JR.

PINE CANYON MATHEWS CANYON

AGRICULTURAL EXPERIMENT STATION
MAX C. FLEISCHMANN COLLEGE OF AGRICULTURE
UNIVERSITY of NEVADA

IN COOPERATION WITH
U.S. DEPARTMENT OF INTERIOR - BUREAU OF LAND MANAGEMENT

PROPERTY OF
Bureau of Land Management
D S C LIBRARY

S
87
.E4
R4
no.46

Bureau of Land Management
Library
Bldg. 50, Denver Federal Center
Denver, CO 80225

#74/5617

88007405

7319
V
R46
S
87
.E4
R4
no.46

VEGETATION AND SOILS of the PINE CANYON AND MATHEWS CANYON WATERSHEDS

Wilbert H. Blackburn[1/], Paul T. Tueller[1/], and Richard E. Eckert, Jr.[2/]

ACKNOWLEDGMENTS

The authors wish to express appreciation to the Las Vegas District, Bureau of Land Management, for historical information of the watersheds.

We wish to thank all those people who have been of assistance by making suggestions, reviewing portions of the manuscript or helping with the field work.

1/Junior Range Ecologist and Associate Range Ecologist, Nevada Agricultural Experiment Station, University of Nevada, Reno.

2/Range Scientist, Crops Research Division, Agriculture Research Service, U. S. Dept. of Agriculture, Reno

Bureau of Land Management
Library
Bldg. 50, Denver Federal Center
Denver, CO 80225

CONTENTS

Page

Introduction 1

Methodology 3

Key to the plant communities in Pine Canyon and Mathews Canyon Watersheds. 7

Black sagebrush *(Artemisia nova)* Community

A. nova/Bromus tectorum Community. 10

Big sagebrush *(Artemisia tridentata)* Communities
A. tridentata/Agropyron desertorum Community 12
A. tridentata/Chrysothamnus nauseosus Community. 14
A. tridentata/Lupinus caudatus Community 16

Rubber Rabbitbrush *(Chrysothamnus nauseosus)* Community
C. nauseosus/Artemisia tridentata Community. 18

Juniper *(Juniperus osteosperma)* Communities
J. osteosperma Community 20
J. osteosperma/Artemisia nova Community. 22
J. osteosperma/Artemisia tridentata/Agropyron desertorum Community 24
J. osteosperma/Artemisia tridentata/Bromus tectorum Community 26
J. osteosperma/Artemisia tridentata/Cowania stansburiana/ Bouteloua gracilis Community. 28
J. osteosperma/Artemisia tridentata/Hilaria jamesii Community 30
J. osteosperma/Artemisia tridentata/Poa secunda Community. . 32
J. osteosperma/Artemisia tridentata/Sitanion hystrix Community 35

Juniper and Pinyon (*Juniperus osteosperma* and *Pinus monophylla* Communities
J. osteosperma/P. monophylla Community 39
J. osteosperma/P. monophylla/Artemisia nova Community. . . . 42
J. osteosperma/P. monophylla/Artemisia tridentata/ Amelanchier pallida Community 44
J. osteosperma/P. monophylla/Chrysothamnus viscidiflorus/ Agropyron desertorum Community 46
J. osteosperma/P. monophylla/Quercus gambelii/Artemisia tridentata Community. 49

Page

Pinyon *(Pinus monophylla)* Communities
P. monophylla/Amelanchier pallida/Arctostophylos patula Community. 51
P. monophylla/Amelanchier pallida/Quercus gambelii Community 53

Pinyon and Juniper *(Pinus monophylla* and *Juniperus osteosperma* Community
P. monophylla/Juniperus osteosperma/Artemisia nova/ Amelanchier pallida Community 56

Ponderosa Pine *(Pinus ponderosa)*Communities
P. ponderosa/Chrysothamnus nauseosus/Bromus tectorum Community 59
P. ponderosa/Quercus gambelii Community. 62

Desert Peach *(Prunus fasciculata)*Community
P. fasciculata/Quercus turbinella/Bromus tectorum Community. 65

Gambel Oak *(Quercus gambelii)* Community
Q. gambelii/Amelanchier pallida Community. 67

Discussion 69

Literature Cited 80

Appendix A. Precipitation Data for Pine Canyon and Methews Canyon Watersheds 82

Appendix B. Soil Families and Subgroups as Associated with the Pine Canyon and Mathews Canyon Watersheds. . . 84

Appendix C. Plant Communities and Soils Association Table for Pine Canyon and Mathews Canyon Watersheds. . . 110

Map - Pine Canyon and Mathews Canyon Watersheds

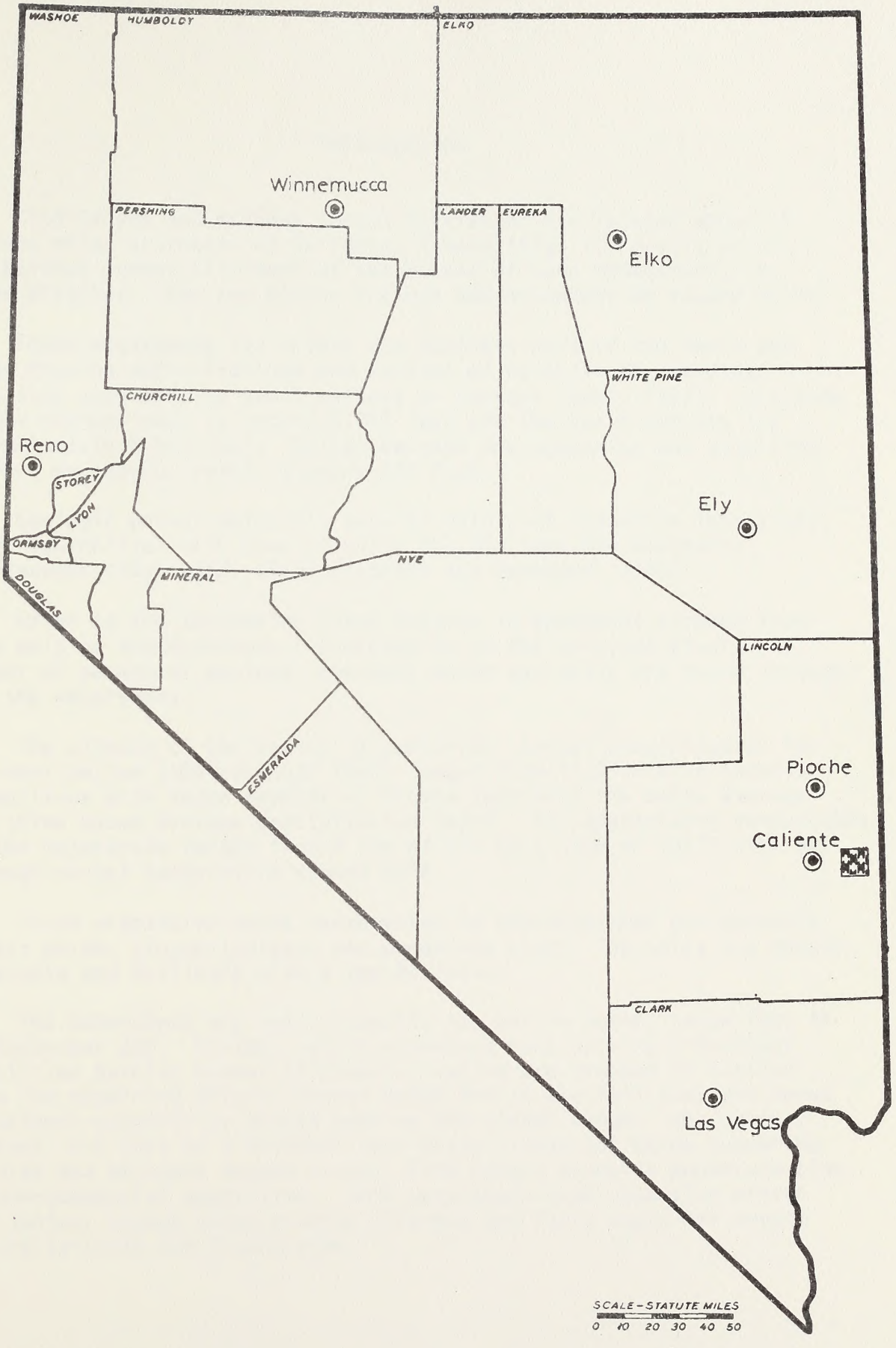


Figure 1. ▩ Location of Pine Canyon And Mathews Canyon Watersheds in Nevada

INTRODUCTION

Pine Canyon and Mathews Canyon Watersheds are located about 18 airline miles southeast of Caliente, Nevada (Fig. 1), mostly within the Barclay Summer Allotment of the Bureau of Land Management, Las Vegas District. The two basins include approximately 66 square miles.

These watersheds lie within the southern part of the Basin and Range Physiographic Province and consist of north-south trending mountains separated by small valleys or canyons (Hunt, 1967). Altitude of the highest peak is around 6,700 feet and the basin outlets are approximately 5,600 feet. Relief between the mountains and adjoining valleys or canyons rarely exceeds 900 feet.

Geologic parent materials consist mainly of volcanics (andesite, tuff, ignimbrite) with some alluvium and old lake bed sediments (tuffaceous clay, sand, silt) (Tschanz and Pampeyan, 1961).

Water in the two basins flows briefly in ephemeral streams from snow melt or thunderstorms. Drainage is to the Colorado River. A number of perennial springs, man-made ponds and wells are found throughout the watersheds.

The climate of the basins is semiarid. Annual precipitation for a 4-year period (1964 through 1967) ranged from 11.9 to 21.8 inches. Comparisons with known records at Pioche indicated one below average and three above average precipitation years. The approximate temperature of the watersheds ranged from a low of 0°F to a high of 101°F with an average annual temperature around 50°F.

Three vegetative zones represented in the watershed are northern desert shrub, pinyon-juniper, and ponderosa pine. The soils are mostly Aridisols and Mollisols with a few Entisols.

The watersheds are used primarily for cattle summer range (May 16 to September 30). Sixteen cattle operators have grazing privileges within the Barclay Summer Allotment. Cattle are trucked or trailed from the adjoining Barclay Winter Range and in the fall they are moved to private property or placed back on the winter range. The basins, however, are part of a critical deer winter range for herds summering in Utah and adjacent Nevada areas. Pine Canyon supports ponderosa pine in non-commercial quantities. Both watersheds have extensive pinyon and juniper stands which provide firewood and fence posts for people in the Caliente and Pioche area.

Land managers constantly require factual information upon which to base their programs. There is a special need for detailed data about the vegetation and soils on rangelands. Material included in this report describes the climax and seral units of vegetation and associated soils in the Pine Canyon and Mathews Canyon Watersheds. They are two of 12 range watershed study areas in Nevada administered by the U. S. Department of the Interior, Bureau of Land Management. The vegetation-soil analysis herein reported is a portion of a co-operative research effort between the Bureau of Land Management and the Renewable Resources Center of the University of Nevada.

This study was designed as a multiple-purpose ecological inventory of vegetation and soil resources. The study provides fundamental information which can be interpreted and re-interpreted as use patterns change and as understanding increases, without the need for a complete re-survey as new uses are emphasized.

The value of data outlined in this report lies in the development of relationships between vegetation and soil and the resultant indicator significance of vegetation. For example, a classification of the basic ecological units is necessary for a thorough understanding of the landscape and for interpretation of site potential. Site potential for a given vegetation-soil unit, however, requires further analysis and the accumulation of data about the value of a management practice if it were applied to the unit in question. Much of these data are not available. Any management recommendation made in this report is curtailed due to a lack of data relating to vegetation-soil units described herein. When such data become available, however, the land manager will be able to easily identify sites within the confines of his unit of responsibility upon which a given practice or management program has been found desirable. An enhanced ability to precisely define range landscapes constitutes the real value of this analysis.

We have attempted to define the vegetation-soil units on the basis of a habitat-type classification. A habitat-type, as defined by Daubenmire (1952) is "the collective area which is capable of supporting the same homogeneous climax plant association." Collective area means a unique ecological entity which can be delineated on a map or aerial photograph. The habitat-type concept indexes site potential since it is an expression of the ultimate unit of the sum environment with regard to vegetation, soil classification unit, topographic placement and micro- and mesoclimatic factors by inference.

As an example, we have interpreted the *Juniperus osteosperma/Pinus monophylla* community to be a habitat-type based on its homogeneity, recurrence, productivity, relict areas, and apparent equilibrium with

its environment. When a community is not climax, careful evaluation of plant, soil, physiographic, and climatological data is necessary in order to speculate as to the probable habitat-type with its specific potential. The *Chrysothamnus nauseosus/Artemisia tridentata* community is an example of seral vegetation. This community occurred on similar soil with similar physiographic placement and climate as *Artemisia tridentata/Elymus cinereus* stands found elsewhere. On these bases, the *C. nauseosus/A. tridentata* community was interpreted to be an *A. tridentata/Elymus cinereus* habitat-type. Similar evaluations have been made for most of the communities recognized in the watershed.

The first section of this report is a dichotomous key to the 25 plant communities. This key refers the reader to the second section, a detailed description of each community. The third section is devoted to a discussion of management suitabilities and ecology of the watersheds. This is followed by the appendices which consists of precipitation data, soil families and sub-groups as associated with the watersheds plant communities and vegetation and soil association table. Finally a watershed map illustrates mapping units which consists of plant communities with their respective percentage indicated, roads, precipitation gages, townships, ranges, and sections.

Methodology

Vegetation of the Pine Canyon and Mathews Canyon Watersheds was delineated into plant communities during a reconnaissance. As a general rule, all communities were recognized and delineated on the basis of vegetative characteristics alone. Then as soil and physiographic data were accumulated, this initial delineation was re-evaluated on several occasions until the 25 plant communities described in this report were finally identified and interpreted. These communities were given names corresponding to the major dominant and major sub-dominant species.

Density and Crown Cover Data

Crown cover data of trees were obtained from a 66- x 132-foot plot. Trees found within the plots were counted by species and 10 typical tree crowns were measured. From this information the density (trees/acre) and average tree cover was computed for each species by plot.

Basal Area and Cover Data

After the plant communities were delineated, an intensive study was initiated by an adaptation of methods described by Poulton and Tisdale (1961) and further modified by Tueller (1962).

A 100-foot-square macroplot was used. Five plots were considered ample to adequately describe a community (Eckert, 1957) but on minor or inaccessible communities, only one or two plots were used.

Permanent macroplots were established by running a 100-foot baseline up and down the slope. Plots placed on the level were oriented north and south.

Within each macroplot, four 4- x 50-foot belt transects were randomly located perpendicular to the baseline. Randomization was restricted to prevent transect overlap and to provide for two transects each in the upper and lower half of the plots. This two-way randomization provides for adequate sampling of the full length of the macroplot (Eckert, 1957).

Each belt transect was divided into two 4- x 5-foot plots thus enabling forty 4- x 5-foot plots to be studied in each macroplot. Two kinds of data were obtained from each plot: (1) basal area of the more abundant grasses and herbs, and (2) crown cover estimates of shrubs. A 1-square-foot frame was used as an estimation guide for both basal area and crown cover data.

Basal area was selected because it is relatively free from yearly weather variations and grazing influences (Tueller, 1962). Dead centers which exceeded 25 percent of the area of bunchgrass were excluded from the estimate. Basal area estimates by species were based on the following cover classes (Poulton, 1962):

Class	Class Range Percent	Midpoint Percent
1	0 - 1	0.5
2	1+ - 5	2.5
3	5+ - 10	7.5
4	10+ - 25	17.5
5	25+ - 50	37.5
6	50+ - 75	62.5
7	75+ - 95	85.0
8	95+ - 100	97.5

The midpoint of each class range was used in calculating cover percentage.

Shrub crown cover estimates were obtained by standing directly over the shrub and projecting the foliage cover onto the ground. Estimates were made for each species to the nearest 1 percent of the 4- x 5-foot plot. Openings in the canopy larger than one-quarter of a square foot were not included.

Frequency Data

Frequency, according to Cain and Castro (1959), is percent presence in plots of a stated size. For example, if a sample of a stand consists of 200 plots, and if one or more plants of a given species occurs in 50 of these plots, the species has a frequency percentage of 25.

Frequency sampling procedures developed by Hyder et al. (1963) were used to supplement cover estimates on each macroplot. Although frequency data are difficult to interpret, the speed and objectivity inherent in the method makes them useful when comparing areas where high statistical precision is needed (Tueller, 1962). Ten frequency transects, each with 20 presence or absence determination quadrats, were located perpendicular to the baseline. Each transect consisted of twenty 20- x 20-inch, 30- x 30-inch, or 12- x 12-inch quadrats placed contiguously and moving away from the baseline. Only those plants rooted inside the frequency quadrats were recorded. A two-stage randomization was applied to these transects: (1) restricting five transects to each half of the macroplot, and (2) preventing transect overlap.

Non-living Ground Cover. Non-living ground cover was determined by an adaptation of the point frame method as described by Goddall (1952). The same 200 frequency plots were used to sample cover but instead of recording presence of vegetation, the bottom tip end of the frequency frame was used as a point. Hits of bare ground, litter, pavement (1/4 to 1-inch diameter) and rock (1-inch plus diameter) were recorded.

Constancy. Cain and Castro (1959) define constancy as "the percentage of occurrence of a species on samples of the same size in various stands of a community type."

Species constancy percentages were calculated for each macroplot. In order to develop a complete species list for constancy, each 100- x 100-square foot macroplot was examined carefully after obtaining cover and frequency data. Additional species encountered were added to the list.

Topographic and Physiographic Features. Topographic features of each macroplot were characterized as follows: position on the slope; whether top, upper one-third, center one-third, lower one-third, or bottom; slope in percent obtained from an abney level; and aspect from an 8-point compass.

Physiographic placement of each macroplot was characterized as follows: land form - drainage bottom, escarpment, fan, floodplain, plateau, flooded depression, ridge top, slope, lake-marine, or river terrace; macrorelief - flat, undulating, rolling, butte, hilly, or mountainous; microrelief - uniform-flat, convex, concave, interrupted-mound, pits, ridge and swale.

Soil Study. A soil profile description was made at each macroplot using procedures outlined in the Soil Survey Manual (USDA, 1951) and the Seventh Approximation (USDA, 1960) plus revisions (USDA, 1967). Horizons, soil color, texture, pH, lime content, structure, and consistence were noted for each profile.

Lack of time and money prevented complete laboratory soil analyses. The following parameters were selected because they have been suggested as indicative of vegetation and soil relationships (Eckert, 1957). Samples from the A1 and B2 horizons were analyzed for conductivity (millimhos per centimeter), pH (from a saturated paste), and organic matter (percent). Cation exchange capacity (milliequivalents per 100 grams) was determined only on those samples from the A1 horizon (USDA Handbook No. 60, 1954).

Family level identifications were made as found in the Seventh Approximation (USDA, 1960) and revisions (USDA, 1967). When more than one profile description per family occurred, the modal description was used to note that family.

Each soil was classified as to: hydrologic group (Nevada Dept. of Conservation and Natural Resources and the USDA, 1965), stoniness (USDA, 1951), and estimated water holding capacity based on clay mineralogy and texture (Schokley, 1955). Available water holding capacity was estimated for the rooting depth, or to the depth of the soil profile studied if not otherwise stated. Rooting depths were limited by duripans and lithic or paralithic contacts.

Soil boundaries were not physically located and a soil map was not made. Thus detailed comparisons of soils across the boundary were not possible or within the scope of this study. Only the soils at the macroplots were described. The kinds of soils noted at the macroplots are commonly associated with the different kinds of vegetation in this watershed.

Climatic Data. Precipitation data were taken for a 4-year period from non-recording rain gages placed throughout the watershed. The data were then related to each applicable community in inches of annual precipitation.

Temperatures were estimated from existing records at Pioche located about 32 miles to the northwest. The area has a climate similar to the watersheds.

Key to the Plant Communities
in the
Pine Canyon and Mathews Canyon Watersheds

A. Communities with a tree overstory

B. Communities with a *Pinus ponderosa* overstory

C. *Chrysothamnus nauseosus* the most abundant shrub with a high frequency of *Bromus tectorum* in the understory .....*Pinus ponderosa/Chrysothamnus nauseosus/ Bromus tectorum* Community. . . . . (p.59)

CC. *Quercus gambelii* dominant in the shrub layer .....*Pinus ponderosa/Quercus gambelii* Community . . . . (p.62)

BB. Communities with a pigmy conifer overstory

C. Communities with a *Juniperus osteosperma* overstory

D. *Juniperus osteosperma* forming a closed community.. .....*Juniperus osteosperma* Community. . . . . (p.20)

DD. *Artemisia nova* dominant in the shrub layer... .....*Juniperus osteosperma/Artemisia nova* Community (p.22)

DDD. *Artemisia tridentata* dominant in the shrub layer

E. *Agropyron desertorum* the most frequent grass .....*Juniperus osteosperma/Artemisia tridentata/ Agropyron desertorum* Community. . . . . (p.24)

EE. *Bromus tectorum* the most frequent grass... .....*Juniperus osteosperma/Artemisia tridentata/ Bromus tectorum* Community. . . . . (p.26)

EEE. *Hilaria jamesii* the most frequent grass... ....*Juniperus osteosperma/Artemisia tridentata/ Hilaria jamesii* Community . . . . . (p.30)

EEEE. *Poa secunda* the most frequent grass.... ...*Juniperus osteosperma/Artemisia tridentata/ Poa secunda* Community. . . . . (p.32)

EEEEE. *Sitanion hystrix* the most frequent grass... ..*Juniperus osteosperma/Artemisia tridentata/ Sitanion hystrix* Community. . . . . (p.35)

DDDD. *Artemisia tridentata* and *Cowania stansburiana* are co-dominant in the shrub layer.

E. *Bouteloua gracilis* the most frequent grass.. ...*Juniperus osteosperma/Artemisia tridentata/ Cowania stansburiana/Bouteloua gracilis* Community. (p.28)

CC. Communities with a *Juniperus osteosperma* and *Pinus monophylla* overstory.

D. *Juniperus osteosperma* and *Pinus monophylla* forming a closed community.....*Juniperus osteosperma/ Pinus monophylla* Community. . . . . .(p.39)

DD. *Artemisia nova* dominant in the shrub layer... .....*Juniperus osteosperma/Pinus monophylla/ Artemisia nova* Community . . . . . .(p.42)

DDD. *Artemisia tridentata* and *Amelanchier pallida* the most characteristic species in the shrub layer ....*Juniperus osteosperma/Pinus monophylla/ Artemisia tridentata/Amelanchier pallida* Community. .(p.44)

DDDD. *Chrysothamnus viscidiflorus* dominant in the shrub layer and *Agropyron desertorum* the most frequent grass .....*Juniperus osteosperma/Pinus monophylla/Chrysothamnus viscidiflorus/Agropyron desertorum* Community . . . . . .(p.46)

DDDDD. *Quercus gambelii* and *Artemisia tridentata* the most abundant species in the shrub layer...*Juniperus osteosperma/Pinus monophylla/Quercus gambelii/ Artemisia tridentata* Community. . . . . .(p.49)

CCC. Communities with a *Pinus monophylla* overstory

D. *Amelanchier pallida* and *Arctostophylos patula* the most characteristic species in the shrub layer.... ....*Pinus monophylla/Amelanchier pallida/Arctostophylos patula* Community. . . . . .(p.51)

DD. *Amelanchier pallida* and *Quercus gambelii* the most characteristic species in the shrub layer..... ....*Pinus monophylla/Amelanchier pallida/Quercus gambelii* Community . . . . . .(p.53)

CCCC. Communities with a *Pinus monophylla* and *Juniperus osteosperma* overstory

D. *Artemisia nova* and *Amelanchier pallida* the most characteristic species in the shrub layer..... ... *Pinus monophylla/Juniperus osteosperma/ Artemisia nova/Amelanchier pallida* Community. . . .(p.56)

AA. Communities not as above

B. Communities with an *Artemisia nova* overstory

C. *Bromus tectorum* the most frequent grass.... ....*Artemisia nova/Bromus tectorum* Community . . . . .(p.10)

BB. Communities with an *Artemisia tridentata* overstory

C. *Agropyron desertorum* the most frequent grass... ...*Artemisia tridentata/Agropyron desertorum* Community(p.12)

CC. *Lupinus caudatus* the most frequent plant in the understory ....*Artemisia tridentata/Lupinus caudatus* Community . . . . . .(p.16)

CCC. *Chrysothamnus nauseosus* a co-dominant in the overstory .....*Artemisia tridentata/Chrysothamnus nauseosus* Community. . . . . .(p.14)

BBB. Communities not as above

C. Communities with a *Chrysothamnus nauseosus* overstory and *Artemisia tridentata* a subdominant..... ...*Chrysothamnus nauseosus/Artemisia tridentata* Community . . . . . .(p.18)

CC. *Prunus fasciculata* and *Quercus turbinella* the most characteristic species in the overstory, with a *Bromus tectorum* understory....*Prunus fasciculata/ Quercus turbinella/Bromus tectorum* Community. . . . .(p.65)

CCC. *Quercus gambelii* and *Amelanchier pallida* the most characteristic species ....*Quercus gambelii/ Amelanchier pallida* Community. . . . . .(p.67)

Black sagebrush *(Artemisia nova)* Community

1. *Artemisia nova/Bromus tectorum* Community

This community has developed in the eastern part of Mathews Canyon Watershed. It is bordered by the *Juniperus osteosperma/Artemisia tridentata/Sitanion hystrix* community on the west and south; the *Pinus monophylla/Juniperus osteosperma/Artemisia nova/Amelanchier pallida* community on the east, and the *Juniperus osteosperma/Artemisia tridentata/Bromus tectorum* community on the north.

The community occurs on north facing slopes of 2 percent, elevation is around 5800 feet, and the mean annual precipitation is 17.1 inches.

Juniper *(Juniperus osteosperma)* is present but very sparse (5.0 trees per acre and trace cover percentage). Black sagebrush *(Artemisia nova)* is the dominant species with 12.0 percent cover and 63.5 percent frequency. Pricklypear *(Opuntia polyacantha)* and bitterbrush *(Purshia tridentata)* occur with 2.0 and 1.0 percent frequency.

Cheatgrass *(Bromus tectorum)* is the only grass found in the community. It has a frequency of 41.0 percent. *Euphorbia sephyllifolia* and *Eriogonum caespitosum* are found with frequency values of 7.5 and 1.0 percent, respectively (Table 1). This community is probably an *Artemisia nova/Bouteloua gracilis* habitat-type.

Pavement accounts for 41.5 percent of the non-living ground cover, litter for 37.5 percent, bare ground for 15.5 percent, and rock for 5.5 percent (Table 2).

The soil at the macroplot where this community was sampled is a member of a fine, mixed, mesic family of Mollic Haplargids (Appendix B-13).

Table 1. Species Density, Cover and Frequency for the *Artemisia nova/Bromus tectorum* Community.

Species	Density**	Cover %	20 x 20* Frequency %
Juniperus osteosperma	5.0	t***	-
Artemisia nova		12.0	63.5
Opuntia polyacantha			2.0
Purshia tridentata			1.0
Bromus tectorum			41.0
Euphorbia sephyllifolia			7.5
Eriogonum caespitosum			1.0

* Frame size in inches
** Trees/acre
*** Trace

Table 2. Non-living Ground Cover for the *Artemisia nova/Bromus tectorum* Community

Material	Cover %
Bare ground	15.5
Litter	37.5
Pavement	41.5
Rock	5.5

Big sagebrush *(Artemisia tridentata)* Communities

1. *Artemisia tridentata/Agropyron desertorum* Community

This community is located in the western part of Mathews Canyon Watershed on undulating fans. The community has resulted from plowing and seeding of the *Juniperus osteosperma/Artemisia tridentata/Sitanion hystrix* community.

The community occurs on northeast and north facing slopes of 6 percent, elevation is 5400 to 5424 feet, and mean annual precipitation is 15.1 inches (Appendix A).

Big sagebrush *(Artemisia tridentata)* is the dominant shrub with 3.8 percent cover and 25.8 percent frequency. Yellowbrush is a subdominant (0.7 percent cover and 17.0 percent frequency) and slenderbrush eriogonum *(Eriogonum microthecum)* when present, occurs in trace amounts. Crested wheatgrass *(Agropyron desertorum)* is the most abundant grass (5.8 percent cover and 68.2 percent frequency). Cheatgrass is fairly frequent with 20.8 percent. Prairie junegrass *(Koeleria cristata)*, squirreltail *(Sitanion hystrix)*, blue grama *(Bouteloua gracilis)* and Thurber needlegrass *(Stipa thurberiana)*, when present, occur with 4.8 percent or less frequency.

Tailcup lupine *(Lupinus caudatus)* and globemallow *(Sphaeralcea coccinea)* occurred in all study plots (100 percent constancy) with 14.0 and 4.2 percent frequency. A number of other forbs occur with small frequency and constancy values (Table 3). This community is probably a *Juniperus osteosperma/Artemisia tridentata/Bouteloua gracilis* habitat-type.

Pavement accounts for 43.5 percent of the non-living ground cover, litter for 41.0 percent, bare ground for 10.5 percent, and rock for 5.0 percent (Table 4).

The soils at the macroplot where this community was described are members of a fine, mixed, mesic family of Mollic Haplargids (Appendix B-13).

Table 3. Species Cover, Frequency and Constancy for the *Artemisia tridentata/Agropyron desertorum* Community

Species	Cover %	20 x 20* Frequency %	Constancy %
Artemisia tridentata	3.8	25.8	100
Chrysothamnus viscidiflorus	0.7	17.0	100
Eriogonum microthecum			50
Agropyron desertorum	5.8	68.2	100
Bromus tectorum		20.8	100
Koeleria cristata		4.8	50
Sitanion hystrix		2.8	50
Bouteloua gracilis		1.0	50
Stipa thurberiana			50
Lupinus caudatus		14.0	100
Sphaeralcea coccinea		4.2	100
Navarretia sp.		3.8	50
Euphorbia sephyllifolia		3.2	50
Comandra pallida		2.8	50
Ipomapsis aggregata		2.8	50
Erigeron peucephyllus		1.8	50
Arabis sp.			50
Astragalus sp.			50
Chaenactis douglasii			50

* Frame size in inches

Table 4. Non-living Ground Cover for the *Artemisia tridentata/Agropyron desertorum* Community

Material	Cover %
Bare ground	10.5
Litter	41.0
Pavement	43.5
Rock	5.0

2. *Artemisia tridentata/Chrysothamnus nauseosus* Community

This community occurs in both Pine Canyon and Mathews Canyon Watersheds in drainage bottoms or as inclusions within the pinyon and juniper dominated communities.

The community is found on northwest or north facing slopes of 2 percent, elevation is around 6300 feet, and the mean annual precipitation is 16.0 inches (Appendix A).

Big sagebrush *(Artemisia tridentata)* is the dominant species with an average of 19.8 percent cover and 61.0 percent frequency. Rubber rabbitbrush *(Chrysothamnus nauseosus)* and yellowbrush *(Chrysothamnus viscidiflorus)* are subdominants with 4.8 and 3.2 percent frequency. Serviceberry *(Amelanchier pallida)*, when present, occurs in trace amounts.

Western wheatgrass *(Agropyron smithii)* and Great Basin wildrye *(Elymus cinereus)* are the most frequent grasses (10.0 and 3.8 percent, respectively). Sandberg bluegrass *(Poa secunda)*, squirreltail *(Sitanion hystrix)*, and fluffgrass *(Tridens pulchellus)* are found in small erratic amounts.

Gilia sinuata and bastard toadflax *(Comandra pallida)* are the most frequent forbs in the community (29.5 and 20.5 percent, respectively). A few additional forbs, when present, occur in small amounts (Table 5). This community is probably an *Artemisia tridentata/Elymus cinereus* habitat-type.

Litter accounts for 73.5 percent of the non-living ground cover, bare ground for 22.8 percent, pavement for 3.5 percent, and rock for 0.2 percent (Table 6).

The soils at the macroplots where the community was sampled are members of a fine-loamy, mixed, frigid family of Pachic Argixerolls (Appendix B-16), or coarse-loamy, mixed, mesic family of typic Haploxerolls (Appendix B-23).

Table 5. Species Cover, Frequency, and Constancy for the *Artemisia tridentata/Chrysothamnus nauseosus* Community

Species	30 x 30* Cover %	Frequency %	Constancy %
Artemisia tridentata	19.8	61.0	100
Chrysothamnus nauseosus		4.8	100
Chrysothamnus viscidiflorus		3.2	50
Amelanchier pallida			50
Agropyron smithii		10.0	50
Elymus cinereus		3.8	50
Poa secunda			50
Sitanion hystrix			50
Tridens pulchellus			50
Gilia sinuata		29.5	50
Comandra pallida		20.5	50
Chenopodium album		3.2	50
Lupinus caudatus		1.8	50
Erigeron bloomeri			50
Sphaeralcea coccinea			50

*Frame size in inches

Table 6. Non-living Ground Cover for the *Artemisia tridentata/Chrysothamnus nauseosus* Community

Material	Cover %
Bare ground	22.8
Litter	73.5
Pavement	3.5
Rock	0.2

3. *Artemisia tridentata/Lupinus caudatus* Community

This community occurs in the southwestern part of Mathews Canyon Watershed and has resulted from burning the *Juniperus osteosoerma/Pinus monophylla* community.

The community occurs on west facing slopes of 3 percent, elevation is around 5900 feet, and the mean annual precipitation is 17.0 inches (Appendix A).

Big sagebrush *(Artemisia tridentata)* is the dominant species with 15.5 percent cover and 82.0 percent frequency. Yellowbrush *(Chrysothamnus viscidiflorus)* and gray horsebrush *(Tetradymia canescens)* are present in small amounts.

Cheatgrass *(Bromus tectorum)* is the most frequent grass with 2.0 percent. Sixweeks fescue *(Festuca octoflora)*, crested wheatgrass *(Agropyron desertorum)* and blue grama *(Bouteloua gracilis)* are found in the community but with small frequency values.

Tailcup lupine *(Lupinus caudatus)* occurs with 11.5 percent frequency and *Astragalus* sp., the only other forb found in the community, had a trace frequency value (Table 7). This community is probably a *Juniperus osteosperma/Pinus monophylla* habitat-type.

Pavement accounts for 38.0 percent of the non-living ground cover, bare ground for 33.0 percent, litter for 29.0 percent and rock for 0.0 percent (Table 8).

The soil at the macroplot where this community was sampled is a member of a fine-loamy, mixed, mesic family of Haplic Mollic Durargids (Appendix B-5).

Table 7. Species Cover and Frequency for the *Artemisia tridentata/Lupinus caudatus* Community

Species	Cover %	20 x 20* Frequency %
Artemisia tridentata	15.5	82.0
Chrysothamnus viscidiflorus		2.0
Tetradymia canescens		t**
Bromus tectorum		2.0
Festuca octoflora		1.5
Agropyron desertorum		1.0
Bouteloua gracilis		t
Lupinus caudatus		11.5
Astragalus sp.		t

* Frame size in inches
** Trace

Table 8. Non-living Ground Cover for the *Artemisia tridentata/Lupinus caudatus* Community

Material	Cover %
Bare ground	33.0
Litter	29.0
Pavement	38.0
Rock	0.0

Rubber Rabbitbrush *(Chrysothamnus nauseosus)* Community

1. *Chrysothamnus nauseosus/Artemisia tridentata* Community

This community is located mostly near the Pine Canyon and Mathews Canyon dam sites where the vegetation was disturbed for the reservoirs or elsewhere as small inclusions.

The community is found on north or northwest facing drainage bottoms of 1.0 to 2.0 percent, elevation is 5300 to 5800 feet, and the mean annual precipitation is 14.6 inches (Appendix A).

Rubber rabbitbrush *(Chrysothamnus nauseosus)* is the dominant species with 31.8 percent cover and 47.0 percent frequency. Big sagebrush *(Artemisia tridentata)* is a sub-dominant with 3.0 percent cover and 7.8 percent frequency, and slenderbrush eriogonum *(Eriogonum microthecum)*, when present, occurs with 1.0 percent frequency.

A number of grasses occur erratically (25 percent frequency) with cheatgrass *(Bromus tectorum)* the most frequent (18.0 percent). All of the forbs occur with constancy ratings of 50 or 25 percent. Lambsquarters goosefoot *(Chenopodium album)* and *Gilia sinuata* are the most frequent with 14.0 and 7.8 percent, respectively (Table 9). This community is probably a seral representative of an *Artemisia tridentata/Elymus cinereus* habitat-type.

Litter accounts for 68.2 percent of the non-living ground cover, bare ground for 30.8 percent, rock for 1.0 percent and pavement for 0.0 percent (Table 10).

The soils at the macroplot where this community was sampled are members of a coarse-loamy, mixed, mesic family of Typic Xerofluvents (Appendix A-1), or coarse-loamy, mixed, mesic family of Typic Haploxerolls (Appendix B-23).

Table 9. Species Cover, Frequency and Constancy for the *Chrysothamnus nauseosus/Artemisia tridentata* Community

Species	Cover %	20 x 20* Frequency %	Constancy %
Chrysothamnus nauseosus	31.8	47.0	100
Artemisia tridentata	3.0	7.8	100
Eriogonum microthecum		1.0	25
Bromus tectorum		18.0	25
Poa secunda			25
Sitanion hystrix			25
Chenopodium album		14.0	50
Gilia sinuata		7.8	25
Chaenactis douglasii		4.6	50
Comandra pallida		3.8	25
Lappula redowskii		2.5	25
Chenopodium leptophyllum		1.2	25
Erigeron bloomeri			25
Helianthus annuus			25
Helianthella uniflora			25

* Frame size in inches

Table 10. Non-living Ground Cover for the *Chrysothamnus nauseosus/Artemisia tridentata* Community

Material	Cover %
Bare ground	30.8
Litter	68.2
Pavement	0.0
Rock	1.0

Juniper *(Juniperus osteosperma)* Communities

1. *Juniperus osteosperma* Community

This community has developed mostly in the northern part of Pine Canyon and Mathews Canyon Watersheds.

The community occurs on north, northeast, east and southeast facing slopes and terraces of 2 to 5 percent, elevation ranges from 5650 to 6000 feet, and the mean annual precipitation is 15.4 inches (Appendix A).

Juniper *(Juniperus osteosperma)* is the dominant species in the community with 229.5 trees per acre and 26.9 percent cover. Pinyon *(Pinus monophylla)*, when present (20 percent constancy), occurs with 19.0 trees/acre and 2.8 percent cover.

Big sagebrush *(Artemisia tridentata)* and yellowbrush *(Chrysothamnus viscidiflorus)* have constancy ratings of 80 and 40 percent, and frequency values of 5.5 and 1.8, respectively. Mormon tea *(Ephedra nevadensis)*, broom snakeweed *(Gutierrezia sarothrae)*, plains prickly-pear *(Opuntia polyacantha)*, slender erigonum *(Eriogonum microthecum)* and bitterbrush *(Purshia tridentata)*occur with small frequency percents, and constancy ratings of 20 to 60 percent.

Squirreltail *(Sitanion hystrix)* is the most frequent grass with 7.2 percent and has a constancy rating of 100 percent. Indian ricegrass *(Oryzopsis hymenoides)*, blue grama *(Bouteloua gracilis)* and Sandberg bluegrass *(Poa secunda)* occur with very small frequency percentages and constancy ratings of 20 to 40 percent.

Mat eriogonum *(Eriogonum caespitosum)*, *Phlox diffusa*, tailcup lupine *(Lupinus caudatus)* and longleaf phlox *(Phlox longifolia)* occur with 80 percent constancy, and 20.7, 10.1, 9.1 and 5.7 percent frequency, respectively. A large number of additional forbs occur with small frequency values and varied constancy percentages (Table 11). This community is a *Juniperus osteosperma* habitat-type.

Litter accounts for 42.4 percent of the non-living ground cover, pavement for 37.6 percent, rock for 10.2 percent, and bare ground for 9.9 percent (Table 12).

The soils at the macroplots where this community was sampled are members of a coarse-loamy, mixed, mesic family of Mollic Durorthids (Appendix B-4); fine, mixed, mesic family of Mollic Durargids (Appendix B-6); fine, mixed, mesic family of Mollic Haplargids (Appendix B-13); or fine, mixed, mesic family of Pachic Argixerolls (Appendix B-21).

Table 11. Species Density, Cover, Frequency and Constancy for the *Juniperus osteosperma* Community

Species	Density**	Cover %	20 x 20* Frequency %	Constancy %
Juniperus osteosperma	229.5	26.9	-	100
Pinus monophylla	19.0	2.8	-	20
Artemisia tridentata			5.5	80
Chrysothamnus viscidiflorus			1.8	40
Ephedra nevadensis			1.3	20
Gutierrezia sarothrae			0.8	60
Opuntia polyacantha			0.6	40
Eriogonum microthecum			0.3	40
Purshia tridentata			0.1	20
Sitanion hystrix			7.2	100
Oryzopsis hymenoides			0.8	20
Bouteloua gracilis			0.4	20
Bromus tectorum			0.2	40
Poa secunda			0.1	20
Eriogonum caespitosum			20.7	80
Phlox diffusa			10.1	80
Lupinus caudatus			9.1	80
Phlox longifolia			5.7	80
Gayophytum sp.			4.6	20
Astragalus lentiginosus			2.8	40
Gilia sinuata			2.7	20
Trifolium gymnocarpon			2.4	20
Erigeron bloomeri			2.2	60
Penstemon kingii			1.8	40
Penstemon palmeri			1.8	40
Aster scopulorum			1.4	40
Zigadenus paniculatus			1.3	20
Chaenactis douglasii			1.1	80
Sphaeralcea coccinea			1.1	20
Agoseris glauca			1.0	60
Eriogonum gracillimum			0.8	20
Cryptantha jamesii			0.6	20
Penstemon caespitosus			0.6	20
Astragalus stenophyllus			0.5	20
Arabis sp.			0.4	20
Lomatium leptocarpum			0.4	40
Astragalus purshii			0.3	20
Caulanthus crassiculis			0.3	20
Balsamorhiza hookeri			0.2	20
Astragalus sp.			0.1	20
Iva axillaris			0.1	20
Balsamorhiza sagittata			0.1	20

* Frame size in inches

** Trees/acre

Table 12. Non-living Ground Cover for the *Juniperus osteosperma* Community

Material	Cover %
Bare ground	9.9
Litter	42.3
Pavement	37.6
Rock	10.2

2. *Juniperus osteosperma/Artemisia nova* Community

This community occurs mostly in the northwest and central part of Mathews Canyon Watershed and to a small extent in Pine Canyon Watershed.

This community occurs on north or northeast facing slopes and terraces of 5 percent, elevation ranges from 5425 to 6100 feet, and the mean annual precipitation is 15.9 inches (Appendix A).

Juniper *(Juniperus osteosperma)* is the dominant species with a density of 150.0 trees per acre and 12.2 percent cover. Pinyon *(Pinus monophylla)*, when present, occurs with 20.0 trees per acre and 0.1 percent cover.

Black sagebrush *(Artemisia nova)* is dominant in the shrub layer with 8.9 percent cover and 42.8 percent frequency. Cliffrose *(Covania stansburiana)*, pricklypear *(Opuntia* sp.), and bitterbrush *(Purshia tridentata)* occur with constancy ratings of 50 percent and trace frequency percents.

Sandberg bluegrass *(Poa secunda)*, cheatgrass *(Bromus tectorum)*, and fluffgrass *(Tridens pulchellus)* are the most frequent grasses (25.2, 16.2, and 10.5 percent, respectively). Squirreltail *(Sitanion hystrix)* and blue grama *(Bouteloua gracilis)* occur with 4.5 and 2.8 percent frequency and 100 percent constancy.

Mat eriogonum *(Eriogonum caepitosum)* occurs with a frequency of 23.8 percent, additional forbs occur with 2.2 percent or less frequency (Table 13). This community is probably a seral representative of a *Juniperus osteosperma/Artemisia nova/Bouteloua gracilis* habitat-type.

Pavement accounts for 42.4 percent of the non-living ground cover, rock for 35.0 percent, litter for 18.8 percent, and bareground for 3.8 percent (Table 14).

The soils at the macroplot where this community was sampled are members of a loamy, mixed, mesic family of Lithic Torriorthents (Appendix B-3), or clayey-skeletal, mixed, mesic family of Mollic Haplargids (Appendix B-12).

Table 13. Species Density, Cover, Frequency and Constancy for the *Juniperus osteosperma/Artemisia nova* Community

Species	Density**	Cover %	20 x 20* Frequency %	Constancy %
Juniperus osteosperma	150.0	12.2	-	100
Pinus monophylla	20.0	0.1	-	50
Artemisia nova		8.9	42.8	100
Cowania stansburiana				50
Opuntia sp.				50
Purshia tridentata				50
Poa secunda		1.0	25.2	100
Bromus tectorum			16.2	50
Tridens pulchellus			10.5	50
Sitanion hystrix			4.5	100
Bouteloua gracilis			2.8	100
Eriogonum caepitosum			23.8	50
Chaenactis douglasii			2.2	100
Astragalus sp.			1.8	50
Calochortus nuttallii				50
Eriogonum andinum				50
Erigeron bloomeri				50

* Frame size in inches
** Trees/acre

Table 14. Non-living Ground Cover for the *Juniperus osteosperma/Artemisia nova* Community

Material	Cover %
Bare ground	3.8
Litter	18.8
Pavement	42.4
Rock	35.0

3. *Juniperus osteosperma/Artemisia tridentata/Agropyron desertorum* Community

This community is located in the northwest and northeast parts of Pine Canyon Watershed. It has resulted from chaining and seeding of the *Juniperus osteosperma/Artemisia tridentata/Sitanion hystrix* and *Juniperus osteosperma/Artemisia tridentata/Poa secunda* communities.

The community occurs on north, northeast, and east facing slopes and terraces of 3 to 12 percent, elevation ranges from 5600 to 6100 feet, and the mean annual precipitation is 15.1 inches (Appendix A).

Juniper *(Juniperus osteosperma)* occurs with 73.2 trees per acre and 2.8 percent cover. Big sagebrush *(Artemisia tridentata)* is dominant in the shrub layer with 4.5 percent cover and 22.9 percent frequency. Yellowbrush *(Chrysothamnus viscidiflorus)* and broom snakeweed *(Gutierrezia sarothrae)* are subdominants with 4.9 and 2.6 percent frequency. Rubber rabbitbrush *(Chrysothamnus nauseosus)*, cliffrose *(Cowania stansburiana)*, slenderbrush eriogonum *(Eriogonum microthecum)*, and plains pricklypear *(Opuntia polyacantha)* have a constancy rating of 17 percent and trace frequency values.

Crested wheatgrass *(Agropyron desertorum)* is the most abundant grass with 5.0 percent cover and 41.9 percent frequency. Squirreltail *(Sitanion hystrix)* and cheatgrass *(Bromus tectorum)* occur with 18.9 and 4.7 percent frequency, respectively, and have constancy ratings of 100 percent. Sandberg bluegrass *(Poa secunda)*, western wheatgrass *(Agropyron smithii)*, Indian ricegrass *(Oryzopsis hymenoides)*, Nevada bluegrass *(Poa nevadensis)* and blue grama *(Bouteloua gracilis)* have frequency values of 3.5 percent or less and constancy ratings of 17 to 67 percent.

Eriogonum andinum, bloomer fleabane *(Erigeron bloomeri)*, longleaf phlox *(Phlox longifolia)*, *Phlox diffusa*, tailcup lupine *(Lupinus caudatus)*, globemallow *(Sphaeralcea coccinea)*, hollyleaf clover *(Trifolium gymnocarpon)*, and pale agoseris *(Agoseris glauca)* occur with 14.8, 13.2, 7.7, 7.5, 5.8, 4.0, 3.7, and 3.5 percent frequency, respectively, and with constancy rating of 67, 100, 83, 50, 83, 100, 67 and 83 percent. A number of additional forbs occur with small frequency and constancy percentages (Table 15). This community is probably a *Juniperus osteosperma/Artemisia tridentata/Bouteloua gracilis* habitat-type.

Litter accounts for 42.9 percent of the non-living ground cover, pavement for 23.0 percent, bare ground for 19.9 percent, and rock for 14.2 percent (Table 16).

The soils at the macroplots where this community was sampled are members of a fine, mixed, mesic family of Mollic Durargids (Appendix B-6), or fine, mixed, mesic family of Mollic Haplargids (Appendix B-13).

Table 15. Species Density, Cover, Frequency and Constancy for the *Juniperus osteosperma/Artemisia tridentata/Agropyron desertorum* Community

Species	Density**	Cover %	30 x 30* Frequency %	Constancy %
Juniperus osteosperma	73.2	2.8	-	100
Artemisia tridentata		4.5	22.9	100
Chrysothamnus viscidiflorus			4.9	100
Gutierrezia sarothrae			2.6	100
Chrysothamnus nauseosus				17
Cowania stansburiana				17
Eriogonum microthecum				17
Opuntia polyacantha				17
Agropyron desertorum		5.0	41.8	100
Sitanion hystrix			18.9	100
Bromus tectorum			4.7	100
Poa secunda			3.5	50
Agropyron smithii			2.1	33
Oryzopsis hymenoides			1.9	67
Poa nevadensis			1.8	17
Bouteloua gracilis			1.7	50
Eriogonum andinum			14.8	67
Erigeron bloomeri			13.2	100
Phlox longifolia			7.7	83
Phlox diffusa			7.5	50
Lupinus caudatus			5.8	83
Sphaeralcea coccinea			4.0	100
Trifolium gymnocarpon			3.7	67
Agoseris glauca			3.5	83
Lepidium montanum			2.2	50
Descurainia sophia			1.1	33
Penstemon kingii			1.1	17
Allium acuminatum				17
Astragalus lentiginosus				17
Astragalus purshii				17
Astragalus stenophyllus				17
Balsamorhiza hookeri				17
Chaenactis douglasii				17
Comandra pallida				17
Ipomopsis aggregata				17
Lepidium perfoliatum				17
Lomatium leptocarpum				17
Lygodesmia spinosa				17
Penstemon palmeri				17

* Frame size in inches
** Trees/acre

Table 16. Non-living Ground Cover for the *Juniperus osteosperma/Artemisia tridentata/Agropyron desertorum* Community

Material	Cover %
Bare ground	19.9
Litter	42.9
Pavement	23.0
Rock	14.2

---

4. *Juniperus osteosperma/Artemisia tridentata/Bromus tectorum* Community

This community has developed in the northeast part of Mathews Canyon Watershed. It is bounded on the west by the *Juniperus osteosperma/Artemisia tridentata/Sitanion hystrix* community, and on the east and north by the *Pinus monophylla/Juniperus osteosperma/Artemisia nova/Amelanchier pallida* community and on the south by the *Artemisia nova/Bromus tectorum* community.

The community occurs on west facing slopes of 3 percent, elevation is around 5900 feet, and the mean annual precipitation is 17.7 inches (Appendix A).

Juniper *(Juniperus osteosperma)* occurs with 10.0 trees per acre and 3.1 percent cover. Big sagebrush *(Artemisia tridentata)* is the dominant shrub with 10.5 percent cover and 34.0 percent frequency. Broom snakeweed *(Gutierrezia sarothrae)*, black sagebrush *(Artemisia nova)* and yellowbrush *(Chrysothamnus viscidiflorus)* occur with frequency values of 9.0, 3.0, and 2.0 percent. A few additional shrubs occur in trace amounts.

Cheatgrass *(Bromus tectorum)* is the most frequent grass (83.5 percent). Squirreltail *(Sitanion hystrix)* and prairie junegrass *(Koeleria cristata)* are less abundant (9.0 and 6.0 percent frequency, respectively).

Euphorbia sephyllifolia and *Haplopappus acaulis* are the most frequent forbs with 17.5 and 14.5 percent, respectively. Additional forbs occur with 5.0 percent or less frequency (Table 17). This community is probably a seral representative of a *Juniperus osteosperma/Artemisia tridentata/Bouteloua gracilis* habitat-type.

Litter accounts for 51.5 percent of the non-living ground cover, pavement for 35.0 percent, rock for 7.0 percent, and bare ground for 6.5 percent (Table 18).

The soil at the macroplot where this community was sampled is a member of a fine, mixed, mesic family of Mollic Haplargids (Appendix B-13).

Table 17. Species Density, Cover and Frequency for the *Juniperus osteosperma/Artemisia tridentata/Bromus tectorum* Community

Species	Density**	Cover %	20 x 20* Frequency %
Juniperus osteosperma	10.0	3.1	-
Artemisia tridentata		10.5	34.0
Gutierrezia sarothrae		0.6	9.0
Artemisia nova			3.0
Chrysothamnus viscidiflorus			2.0
Opuntia polyacantha			1.5
Amelanchier pallida			t***
Purshia tridentata			t
Bromus tectorum			83.5
Sitanion hystrix			9.0
Koeleria cristata			6.0
Euphorbia sephyllifolia			17.5
Haplopappus acaulis			14.5
Balsamorhiza hookeri			5.0
Astragalus sp.			4.5
Calochortus nuttallii			2.0
Arabis sp.			1.5
Chenopodium album			t
Eriogonum caespitosum			t

* Frame size in inches
** Trees/acre
*** Trace

Table 18. Non-living Ground Cover for the *Juniperus osteosperma/Artemisia tridentata/Bromus tectorum* Community

Material	Cover %
Bare ground	6.5
Litter	51.5
Pavement	35.0
Rock	7.0

5. *Juniperus osteosperma/Artemisia tridentata/ Cowania stansburiana/Bouteloua gracilis* Community

This community is found in the northwest part of Mathews Canyon Watershed. It is bounded on the south and east by the *Juniperus osteosperma/Artemisia tridentata/Sitanion hystrix* community, on the west by the *Juniperus osteosperma/Artemisia tridentata/Hilaria jamesii* community, and on the north by the watershed boundary.

The community occurs on south facing slopes of 7 percent, elevation is around 6025 feet, and the mean annual precipitation is 14.9 inches (Appendix A).

Juniper *(Juniperus osteosperma)* is the dominant overstory species with 35.0 trees per acre and 4.2 percent cover. Pinyon is present with 10.0 trees per acre and 0.1 percent cover. Big sagebrush *(Artemisia tridentata)* and cliffrose *(Cowania stansburiana)* are the most abundant shrubs (9.4 and 3.3 percent cover, and 59.0 and 8.0 percent frequency, respectively). Bitterbrush *(Purshia tridentata)* occurs with a frequency of 1.5 percent.

Blue grama *(Bouteloua gracilis)*, squirreltail *(Sitanion hystrix)* and Nevada bluegrass *(Poa nevadensis)* occur with cover values of 4.8, 0.6, and 0.4 percent, and frequency values of 19.0, 19.0, and 13.0 percent. Additional grasses are present with small frequency percents.

Mat eriogonum *(Eriogonum caespitosum)* is the most frequent forb with 11.5 percent. *Eriogonum* sp., Russian thistle *(Salsola kali* var. *tenuifolia)*, and globemallow *(Sphaeralcea coccinea)* occur with 2.5, 1.0 and 1.0 percent frequency, respectively. (Table 19). This community is probably a *Juniperus osteosperma/Cowania stansburiana/Artemisia tridentata/Bouteloua gracilis* habitat-type.

Litter accounts for 35.0 percent of the non-living ground cover, pavement for 29.5 percent, rock for 25.0 percent, and bare ground for 10.5 percent (Table 20).

The soil at the macroplot where this community was sampled is a member of a loamy, mixed, mesic family of Lithic Torriorthents (Appendix B-3).

Table 19. Species Density, Cover and Frequency for the *Juniperus osteosperma/Artemisia tridentata/Cowania stansburiana/Bouteloua gracilis* Community

Species	Density**	Cover %	20 x 20* Frequency %
Juniperus osteosperma	35.0	4.2	-
Pinus monophylla	10.0	0.1	-
Artemisia tridentata		9.4	59.0
Cowania stansburiana		3.3	8.0
Purshia tridentata			1.5
Bouteloua gracilis		4.8	19.0
Sitanion hystrix		0.6	19.0
Poa nevadensis		0.4	13.0
Oryzopsis hymenoides			2.5
Bromus tectorum			2.0
Sporobolus cryptandrus			t***
Eriogonum caespitosum		0.7	11.5
Eriogonum sp.			2.5
Salsola kali var. *tenuifolia*			1.0
Sphaeralcea coccinea			1.0

* Frame size in inches
** Trees/acre
*** Trace

Table 20. Non-living Ground Cover for the *Juniperus osteosperma/Artemisia tridentata/Cowania stansburiana/Bouteloua gracilis* Community

Material	Cover %
Bare ground	10.5
Litter	35.0
Pavement	29.5
Rock	25.0

6. *Juniperus osteosperma/Artemisia tridentata/Hilaria jamesii* Community

This community is found in the northwest part of Mathews Canyon Watershed. It is bounded on the east by the *Juniperus osteosperma/Artemisia tridentata/Cowania stansburiana/Bouteloua gracilis* community, on the south by the *Artemisia tridentata/Chrysothamnus nauseosus* and *Chrysothamnus nauseosus/Artemisia tridentata* communities, and on the west and north by the watershed boundary.

The community occurs on south facing slopes of 6 percent, elevation is around 5400 feet, and the mean annual precipitation is 14.1 inches (Appendix A).

Juniper *(Juniperus osteosperma)* occurs with a density of 35.0 trees per acre and 8.1 percent cover. Big sagebrush *(Artemisia tridentata)* and yellowbrush *(Chrysothamnus viscidiflorus)* are present in the shrub layer with 11.5 and 0.9 percent cover, and 61.5 and 0.5 percent frequency, respectively.

Galleta *(Hilaria jamesii)* and squirreltail *(Sitanion hystrix)* are the most abundant grasses (0.8 and 0.6 percent cover, and 24.0 and 18.0 percent frequency, respectively). Blue grama *(Bouteloua gracilis)*, needle-and-thread *(Stipa comata)*, and Indian ricegrass *(Oryzopsis hymenoides)* occur with frequency values of 9.5, 4.5 and 2.0 percent, respectively.

A number of forbs are present with *Eriogonum* sp. and mat eriogonum *(Eriogonum caespitosum)* the most frequent with 5.0 and 2.5 percent (Table 21). This community is probably a *Juniperus osteosperma/Artemisia tridentata/Hilaria jamesii* habitat-type.

Pavement accounts for 50.5 percent of the non-living ground cover, litter for 38.5 percent, bare ground for 6.5 percent, and rock for 4.5 percent (Table 22).

The soil at the macroplot where this community was sampled is a member of a fine, mixed, mesic family of the Mollic Durargids (Appendix B-6).

Table 21. Species Density, Cover and Frequency for the *Juniperus osteosperma/Artemisia tridentata/ Hilaria jamesii* Community

Species	Density**	Cover %	20 x 20* Frequency %
Juniperus osteosperma	35.0	8.1	-
Artemisis tridentata		11.5	61.5
Chrysothamnus viscidiflorus		0.9	0.5
Hilaria jamesii		0.8	24.0
Sitanion hystrix		0.6	18.0
Bouteloua gracilis			9.5
Stipa comata			4.5
Oryzopsis hymenoides			2.0
Eriogonum sp.			5.0
Eriogonum caespitosum			2.5
Cordylanthus ramosus			2.0
Chaenactis douglasii			1.0
Lepidium perfoliatum			1.0
Sphaeralcea coccinea			1.0
Senecio integerrimus			1.0

*Frame size in inches
**Trees/acre

Table 22. Non-living Ground Cover for the *Juniperus osteosperma/Artemisia tridentata/Hilaria jamesii* Community

Material	Cover %
Bare ground	6.5
Litter	38.5
Pavement	50.5
Rock	4.5

7. *Juniperus osteosperma/Artemisia tridentata/Poa secunda* Community

This community has developed in the northern part of the Pine Canyon Watershed on hills and mountains.

The community occurs on north or northwest facing slopes of 3 to 17 percent, elevation is around 6000 feet, and the mean annual precipitation is 15.1 inches (Appendix A).

Juniper *(Juniperus osteosperma)* and big sagebrush *(Artemisia tridentata)* are the most characteristic species in the community. Respectively, they provide 0.6 and 9.4 percent cover. Juniper has a density of 12.5 trees per acre and big sagebrush frequency is 38.2 percent. Yellowbrush *(Chrysothamnus viscidiflorus)*, broom snakeweed *(Gutierrezia sarothrae)*, slenderbrush eriogonum *(Eriogonum microthecum)*, and bitterbrush *(Purshia tridentata)*, when present, are usually found with low frequency.

Sandberg bluegrass *(Poa secunda)* and cheatgrass *(Bromus tectorum)* occur with 2.1 and trace percent cover, and 65.8 and 48.5 percent frequency. Blue grama *(Bouteloua gracilis)*, squirreltail *(Sitanion hystrix)* and needle-and-thread *(Stipa comata)* are found with lower frequency values (15.5, 11.5 and trace percent, respectively).

Eriogonum andinum, pepperweed *(Lepidium montanum)* and thorn skeletonplant *(Lygodesmia spinosa)* have constancy ratings of 50 percent and frequency percents of 11.5, 11.0 and 9.5, respectively. Additional forbs are found with varied constancy and low frequency values (Table 23). This community is probably a seral representative of a *Juniperus osteosperma/Artemisia tridentata/Bouteloua gracilis* habitat-type.

Litter accounts for 42.2 percent of the non-living ground cover, bare ground for 33.8 percent, pavement for 15.8 percent, and rock for 8.2 percent (Table 24).

The soils at the macroplots where this community was sampled are members of a loamy-skeletal, mixed, mesic family of Typic Torriorthents (Appendix B-2), or fine, mixed, mesic family of Mollic Durargids (Appendix B-6).

Table 23. Species Density, Cover, Frequency and Constancy for the *Juniperus osteosperma/Artemisia tridentata/ Poa secunda* Community

Species	Density**	Cover %	20 x 20* Frequency %	Constancy %
Juniperus osteosperma	12.5	0.6	-	100
Artemisia tridentata		9.4	38.2	100
Chrysothamnus viscidiflorus			12.8	50
Gutierrezia sarothrae			2.2	50
Eriogonum microthecum				50
Purshia tridentata				50
Poa secunda		2.1	65.8	100
Bromus tectorum		t***	48.5	100
Bouteloua gracilis			15.5	100
Sitanion hystrix			11.5	100
Stipa comata				50
Eriogonum andinum			11.5	50
Lepidium montanum			11.0	50
Lygodesmia spinosa			9.5	50
Erigeron bloomeri			6.5	100
Phlox longifolia			5.0	50
Lepidium perfoliatum			3.8	50
Chaenactis douglasii			2.8	100
Lupinus caudatus			2.2	100
Agoseris glauca				50
Astragalus lentiginosus				50
Aster scopulorum				50
Descurainia sophia				50
Sphaeralcea coccinea				50

* Frame size in inches
** Trees/acre
*** Trace

Table 24. Non-living Ground Cover for the *Juniperus osteosperma/Artemisia tridentata/Poa secunda* Community

Material	Cover %
Bare ground	33.8
Litter	42.2
Pavement	15.8
Rock	8.2

8. *Juniperus osteosperma/Artemisia tridentata/ Sitanion hystrix* Community

This community occurs in the north, central, and western part of Mathews Canyon Watershed and in the northern part of Pine Canyon Watershed on undulating slopes, hills and mountains.

This community is found on north, northeast, east, and south facing slopes of 1 to 20 percent, elevation ranges from 5300 to 6120 feet, and the mean annual precipitation is 15.8 inches (Appendix A).

Juniper *(Juniperus osteosperma)* is the dominant species with a density of 146.4 trees per acre and 19.9 percent cover. Pinyon *(Pinus monophylla)*, when present, occurs with a density of 13.3 trees per acre and 0.6 percent cover.

Big sagebrush *(Artemisia tridentata)* is the most abundant shrub (7.2 percent cover and 23.8 percent frequency). Broom snakeweed *(Gutierrezia sarothrae)* and yellowbrush *(Chrysothamnus viscidiflorus)* are found with constancy ratings of 50 and 75 percent and frequency percent of 3.0 and 2.1. Additional shrubs occur with varied constancy percents and trace frequency values.

Squirreltail *(Sitanion hystrix)* is the most frequent and highly constant grass (12.8 percent frequency and 100 percent constancy). Sandberg bluegrass *(Poa secunda)*, blue grama *(Bouteloua gracilis)*, crested wheatgrass *(Agropyron desertorum)* and cheatgrass *(Bromus tectorum)* occur with small frequency and varied constancy. Respectively, they provide 5.2, 3.2, 2.6 and 2.3 percent frequency and 42, 50, 25 and 75 percent constancy. A number of additional grasses are found with small frequency and constancy percents.

A large number and variety of forbs are found in the community. *Eriogonum andinum*, longleaf phlox *(Phlox longifolia)*, and mat eriogonum *(Eriogonum caespitosum)* are the most frequent with 14.8, 5.9 and 5.8 percent, respectively (Table 25). This community is probably a *Juniperus osteosperma/Artemisia tridentata/Bouteloua gracilis* habitat-type.

Litter accounts for 45.6 percent of the non-living ground cover, pavement for 34.5 percent, bare ground for 11.1 percent and rock for 8.8 percent (Table 26).

The soils at the macroplots where this community was sampled are members of a fine, mixed, mesic family of Mollic Durargids (Appendix B-6); fine mixed, mesic family of Mollic Haplargids (Appendix B-13); fine, mixed, mesic family of Typic Argixerolls (Appendix B-17); or fine, mixed, mesic family of Duric Argixerolls (Appendix B-19).

Table 25. Species Density, Cover, Frequency and Constancy for the *Juniperus osteosperma/Artemisia tridentata/ Sitanion hystrix* Community

Species	Density**	Cover %	20 x 20* Frequency %	Constancy %
Juniperus osteosperma	146.4	19.9	-	100
Pinus monophylla	13.3	0.6	-	50
Artemisia tridentata		7.2	23.8	100
Gutierrezia sarothrae			3.0	50
Chrysothamnus viscidiflorus			2.1	75
Opuntia polyacantha				50
Purshia tridentata				50
Eriogonum microthecum				25
Chrysothamnus nauseosus				8
Sitanion hystrix			12.8	100
Poa secunda			5.2	42
Bouteloua gracilis			3.2	50
Agropyron desertorum			2.6	25
Bromus tectorum			2.3	75
Oryzopsis hymenoides				58
Koeleria cristata				17
Agropyron smithii				8
Poa nevadensis				8
Stipa comata				8
Stipa thurberiana				8
Eriogonum andinum			14.8	67
Phlox longifolia			5.9	58
Eriogonum caespitosum			5.8	25
Lupinus caudatus			3.8	75
Erigeron bloomeri			3.4	42
Cordylanthus ramosus			2.0	17
Zigadenus paniculatus			2.0	33
Gilia sinuata			1.8	8
Lepidium montanum			1.5	33

Table 25. (cont'd)

Species	Density**	Cover %	20 x 20* Frequency %	Constancy %
Phlox diffusa			1.3	25
Chaenactis douglasii			1.2	58
Ipomopsis aggregata			1.0	50
Agoseris glauca				50
Astragalus lentiginosus				50
Astragalus sp.				33
Astragalus stenophyllus				25
Lomatium leptocarpum				25
Penstemon kingii				25
Balsamorhiza hookeri				17
Crepis occidentalis				17
Gayophytum sp.				
Iva axillaris				17
Lygodesmia spinosa				17
Penstemon sp.				17
Penstemon palmeri				17
Phlox stansburyi				17
Trifolium gymnocarpon				17
Aster scopulorum				8
Chenopodium albescens				8
Comandra pallida				8
Cryptantha jamesii				8
Delphinium andersonii				8
Euphorbia sephyllifolia				8
Haplopappus acaulis				8
Lepidium perfoliatum				8
Penstemon linarioides				8
Sphaeralcea coccinea				8

* Frame size in inches
** Trees/acre

Table 26. Non-living Ground Cover for the *Juniperus osteosperma/Artemisia tridentata/Sitanion hystrix* Community

Material	Cover %
Bare ground	11.1
Litter	45.6
Pavement	34.5
Rock	8.8

Juniper and Pinyon (*Juniperus osteosperma* and *Pinus monophylla* Communities

1. *Juniperus osteosperma/Pinus monophylla* Community

This community has developed mostly in the central part of Pine Canyon Watershed with a small amount in the western part of Mathews Canyon Watershed.

The community occurs on all aspects of 5 to 22 percent slope, elevation ranges from 6000 to 6200 feet, and the mean annual precipitation is 17.0 inches (Appendix A).

Juniper *(Juniperus osteosperma)* and pinyon *(Pinus monophylla)* are the dominant species (97.1 and 190.0 trees per acre, and 9.0 and 6.5 percent cover) and form a closed community.

Big sagebrush *(Artemisia tridentata)* occurred in all stands sampled (100 percent constancy) with 11.8 percent frequency. A number of other shrubs occur erratically (67 to 33 percent constancy) and with low frequency values (5.7 to trace percent).

Squirreltail *(Sitanion hystrix)*, Sandberg bluegrass *(Poa secunda)* and Nevada bluegrass *(Poa nevadensis)* are the most frequent grasses. Respectively, they account for 15.6, 10.9 and 5.2 percent frequency and 100, 83 and 67 percent constancy. Cheatgrass *(Bromus tectorum)* and blue grama *(Bouteloua gracilis)* are more erratic in their occurrence with constancy ratings of 50 and 33 percent.

A large variety of forbs occur with varied frequency values and constancy ratings. Bastard toadflax *(Comandra pallida)*, *Gilia sinuata*, bloomer fleabane *(Erigeron bloomeri)* and *Eriogonum andinum* are the most frequent with 18.2, 16.2, 12.8 and 11.2 percent, respectively. They have constancy ratings of 100, 83, 100 and 67 percent, respectively (Table 27). This community is a *Juniperus osteosperma/Pinus monophylla* habitat-type.

Litter accounts for 51.5 percent of the non-living ground cover, rock for 21.2 percent, pavement for 18.3 percent and bare ground for 9.0 percent (Table 28).

The soils at the macroplots where this community was sampled are members of a fine, mixed, frigid family of Duric Mollic Haplargids (Appendix B-7); loamy-skeletal, mixed, frigid family of Mollic Haplargids (Appendix (B-11); fine, mixed, mesic family of Mollic Haplargids (Appendix B-13); or fine, mixed, frigid family of Mollic Haplargids (Appendix B-14).

Table 27. Species Density, Cover, Frequency and Constancy for the *Juniperus osteosperma/Pinus monophylla* Community

Species	Density**	Cover %	30 x 30* Frequency %	Constancy %
Juniperus osteosperma	97.1	9.0	-	100
Pinus monophylla	190.0	6.5		100
Artemisia tridentata			11.8	100
Chrysothamnus viscidiflorus			5.7	33
Quercus gambelii			1.4	50
Amelanchier pallida				67
Eriogonum microthecum				33
Opuntia polyacantha				33
Sitanion hystrix			15.6	100
Poa secunda			10.9	83
Poa nevadensis			5.2	67
Bromus tectorum				50
Bouteloua gracilis				33
Comandra pallida (12 x 12)*			18.2	100
Gilia sinuata (12 x 12)*			16.2	83
Erigeron bloomeri			12.8	100
Eriogonum andinum			11.2	67
Lomatium leptocarpum			7.5	50
Phlox longifolia			7.4	67
Phlox diffusa			5.2	83
Agoseris glauca			3.2	83
Zigadenus paniculatus			3.2	33
Crepis occidentalis			2.4	17
Astragalus lentiginosus			2.2	83
Lewisia rediviva			1.7	33
Allium acuminatum			1.5	17
Chaenactis douglasii			1.4	67

Table 27 (cont'd)

Species	Density**	Cover %	30 x 30* Frequency %	Constancy %
Lupinus caudatus			1.4	67
Calochortus nuttallii				67
Ipomopsis aggregata				50
Astragalus stenophyllus				33
Balsamorhiza hookeri				33
Lithophragma bulbifera				33
Trifolium gymnocarpon				33
Arabis holboellii				17
Astragalus purshii				17
Balsamorhiza sagittata				17
Delphinium andersonii				17
Fritillaria atropurpurea				17
Iva axillaris				17
Lepidium perfoliatum				17
Cryptantha jamesii				17
Mimulus suksdorfii				17

* Frame size in inches
** Trees/acre

Table 28. Non-living Ground Cover for the *Juniperus osteosperma/Pinus monophylla* Community

Material	Cover %
Bare ground	9.0
Litter	51.5
Pavement	18.3
Rock	21.2

2. *Juniperus osteosperma/Pinus monophylla/Artemisia nova* Community

This community occurs on ridges in the south central part of Pine Canyon Watershed.

The community occurs on northeast facing slopes of 2 percent, elevation is around 6350 feet, and the mean annual precipitation is 17.2 inches (Appendix A).

Juniper *(Juniperus osteosperma)* and pinyon *(Pinus monophylla)* are the dominant species with 270.0 and 1850.0 trees per acre and 46.8 and 28.5 percent cover.

Black sagebrush *(Artemisia nova)* is the most dominant shrub (6.9 percent cover and 28.0 percent frequency) with big sagebrush *(Artemisia tridentata)* and Gambel oak *(Quercus gambelii)* present in trace amounts.

Squirreltail *(Sitanion hystrix)*, cheatgrass *(Bromus tectorum)* and Nevada bluegrass *(Poa nevadensis)* occur with 8.0, 7.0 and 5.5 percent frequency, respectively.

Mat eriogonum *(Eriogonum caespitosum)*, *Astragalus* sp., thymeleaf euphorbia *(Euphorbia serpyllifolia)*, and pepperweed *(Lepidium letocarpum)* respectively, occur with 15.0, 3.0 and 2.5 and trace percent frequency (Table 29). This community is probably a *Juniperus osteosperma/Pinus monophylla/Artemisia nova/Bouteloua gracilis* habitat-type.

Litter accounts for 51.0 percent of the non-living ground cover, pavement for 40.0 percent, rock for 6.5 percent, and bare ground for 2.5 percent (Table 30).

The soil at the macroplot where the community was sampled is a member of a fine, mixed, mesic family of Mollic Haplargids (Appendix B-13).

Table 29. Species Density, Cover and Frequency for the *Juniperus osteosperma/Pinus monophylla/ Artemisia nova* Community

Species	Density**	Cover %	20 x 20* Frequency %
Juniperus osteosperma	270.0	46.8	-
Pinus monophylla	1850.0	28.5	
Artemisia nova		6.9	28.0
Artemisia tridentata			t***
Quercus gambelii			t
Sitanion hystrix			8.0
Bromus tectorum			7.0
Poa nevadensis			5.5
Eriogonum caespitosum			15.0
Astragalus sp.			3.0
Euphorbia sephyllifolia			2.5
Lomatium leptocarpum			t

* Frame size in inches
** Trees/acre
*** Trace

Table 30. Non-living Ground Cover for the *Juniperus osteosperma/Pinus monophylla/Artemisia nova* Community

Material	Cover %
Bare ground	2.5
Litter	51.0
Pavement	40.0
Rock	6.5

3. *Juniperus osteosperma/Pinus monophylla/Artemisia tridentata/Amelanchier pallida* Community

This community has developed on mountainous slopes in the western part of Pine Canyon Watershed and in the southern part of Mathews Canyon Watershed.

The community is found on northeast and west facing slopes of 6 to 38 percent, elevation ranges from 5700 to 6100 feet, and the mean annual precipitation is 15.8 inches (Appendix A).

Juniper *(Juniperus osteosperma)* and pinyon *(Pinus monophylla)* are the dominant species with a density of 35.0 and 90.0 trees per acre and 15.3 and 2.4 percent cover, respectively.

Big sagebrush *(Artemisia tridentata)* and serviceberry *(Amelanchier pallida)* are the most characteristic species in the shrub layer with 11.2 and 9.2 percent cover, and 33.8 and 13.0 percent frequency, respectively. Gambel oak *(Quercus gambelii)* and bitterbrush *(Purshia tridentata)* respectively, are found with cover values of 7.8 and trace percentages and frequency values of 16.0 and trace percentages.

Squirreltail *(Sitanion hystrix)* and cheatgrass *(Bromus tectorum)* are the most abundant grasses with 8.8 and 5.2 percent frequency. Prairie junegrass *(Koeleria cristata)* and Indian ricegrass *(Oryzopsis hymenoides)* occur with constancy ratings of 50 percent and 2.8 and trace percent frequency.

A number of forbs are found in the community. The most abundant are longleaf phlox *(Phlox longifolia)*, specklepod locoweed *(Astragalus lentiginosus)*, sunflower *(Helianthus bolanderi)* and *Ipomopsis aggregata* with frequency of 2.2, 1.8, 1.6 and 1.6 percent and constancy ratings of 100, 50, 50 and 50 percent, respectively (Table 31). This community is probably a seral representative of a *Juniperus osteosperma/Pinus monophylla/Amelanchier pallida/Purshia tridentata* habitat-type.

Litter accounts for 57.8 percent of the non-living ground cover, pavement for 22.0 percent, rock for 13.0 percent and bare ground for 7.2 percent (Table 32).

The soils at the macroplots where this community was sampled are members of a clayey-skeletal, mixed, frigid family of Lithic Mollic Haplargids (Appendix B-9); or fine, mixed, frigid, shallow family of Typic Argixerolls (Appendix B-20).

Table 31. Species Density, Cover, Frequency and Constancy for the *Juniperus osteosperma/Pinus monophylla/Artemisia tridentata/Amelanchier pallida* Community

Species	Density**	Cover %	20 x 20* Frequency %	Constancy %
Juniperus osteosperma	35.0	15.3	-	100
Pinus monophylla	90.0	2.4		100
Artemisia tridentata		11.2	33.8	100
Amelanchier pallida		9.2	13.0	100
Quercus gambelii		7.8	16.0	50
Purshia tridentata				100
Sitanion hystrix			8.8	50
Bromus tectorum			5.2	100
Koeleria cristata			2.8	50
Oryzopsis hymenoides				50
Phlox longifolia			2.2	100
Astragalus lentiginosus			1.8	50
Helianthus bolanderi			1.6	50
Ipomopsis aggregata			1.6	50
Balsamorhiza sagittata			1.5	100
Calochortus nuttallii			1.2	100
Lupinus sp.			1.2	50
Allium acuminatum				50
Astragalus sp.				50
Chaenactis douglasii				50
Delphinium andersonii				50
Eriogonum caespitosum				50
Lupinus caudatus				50

* Frame size in inches
** Trees/acre

Table 32. Non-living Ground Cover for the *Juniperus osteosperma/Pinus monophylla/Artemisia tridentata/Amelanchier pallida* Community

Material	Cover %
Bare ground	7.2
Litter	57.8
Pavement	22.0
Rock	13.0

4. *Juniperus osteosperma/Pinus monophylla/Chrysothamnus viscidiflorus/Agropyron desertorum* Community.

This community has developed as a result of chaining juniper *(Juniperus osteosperma)* and pinyon *(Pinus monophylla)*, and seeding crested wheatgrass *(Agropyron desertorum)*. It is found on ridges in the western and eastern part of Pine Canyon Watershed.

The community occurs on east facing slopes of 4 percent, elevation is around 6000 feet, and the mean annual precipitation is 16.9 inches (Appendix A).

Juniper and pinyon trees that were too young to be affected or were tipped over by the chaining, account for a density of 144.0 and 89.0 trees per acre, and 3.4 and 2.8 percent cover, respectively.

Yellowbrush *(Chrysothamnus viscidiflorus)* and big sagebrush *(Artemisia tridentata)* are the most frequent shrubs (11.0 and 4.0 percent). Broom snakeweed (*Gutierrezia sarothrae)*, bitterbrush *(Purshia tridentata)*, plains pricklypear *(Opuntia polyacantha)* and cliffrose *(Cowania stansburiana)* are found in the community but in small amounts.

Squirreltail *(Sitanion hystrix)* and crested wheatgrass occur with 51.0 and 43.5 percent frequency, respectively. Cheatgrass *(Bromus tectorum)*, Nevada bluegrass *(Poa nevadensis)*, Indian ricegrass *(Oryzopsis hymenoides)*, and blue grama *(Bouteloua gracilis)* occur with small frequency values (13.0, 10.0, 6.0 and 3.5 percent, respectively).

A number of forbs occur in the community. *Eriogonum andinum*, hollyleaf clover *(Trifolium gymnocarpon)* and bloomer fleabane *(Erigeron bloomeri)* are the most frequent (34.5, 19.0 and 15.5 percent, respectively) (Table 34). This community is probably a *Juniperus osteosperma/Pinus monophylla* habitat-type.

Litter accounts for 48.0 percent of the non-living ground cover, rock for 21.0 percent, pavement for 16.0 percent, and bare ground for 15.0 percent (Table 35).

The soil at the macroplot where this community was sampled is a member of a fine, mixed, mesic family of Mollic Haplargids (Appendix B-13).

Table 33. Species Density, Cover and Frequency for the *Juniperus osteosperma/Pinus monophylla/Chrysothamnus viscidiflorus/Agropyron desertorum* Community

Species	Density**	Cover %	20 x 20* Frequency %
Juniperus osteosperma	144.0	3.4	
Pinus monophylla	89.0	2.8	
Chrysothamnus viscidiflorus			11.0
Artemisia tridentata			4.0
Gutierrezia sarothrae			2.0
Purshia tridentata			2.0
Opuntia polyacantha			1.5
Cowania stansburiana			1.0
Sitanion hystrix			51.0
Agropyron desertorum			43.5
Bromus tectorum			13.0
Poa nevadensis			10.0
Oryzopsis hymenoides			6.0
Bouteloua gracilis			3.5
Eriogonum andinum			34.5
Trifolium gymnocarpon			19.0
Erigeron bloomeri			15.5
Penstemon kingii			6.5
Sphaeralcea coccinea			6.0
Lomatium leptocarpum			5.5
Lupinus caudatus			5.5
Descurainia sophia			2.2
Agoseris glauca			3.5
Penstemon palmeri			1.0

* Frame size in inches
** Trees/acre

Table 34. Non-living Ground Cover for the *Juniperus osteosperma/Pinus monophylla/Chrysothamnus visvidiflorus/Agropyron desertorum* Community

Material	Cover %
Bare ground	15.0
Litter	48.0
Pavement	16.0
Rock	21.0

5. *Juniperus osteosperma/Pinus monophylla/Quercus gambelii/Artemisia tridentata* Community.

This community is located in the southeast part of Mathews Canyon Watershed. It is bordered on the south and east by the *Juniperus osteosperma/Pinus monophylla/Artemisia tridentata/Amelanchier pallida* community and on the west and north by the *Juniperus osteosperma/Artemisia tridentata/Sitanion hystrix* or *Artemisia tridentata/Chrysothamnus nauseosus* communities.

Juniper (*Juniperus osteosperma)* and pinyon *(Pinus monophylla)* are the most characteristic species. Respectively, they occur with a density of 55.0 and 45.0 trees per acre, and 14.8 and 2.4 percent cover.

Gambel oak *(Quercus gambelii)* and big sagebrush *(Artemisia tridentata)* are the most abundant shrubs. They are found with an average cover percent of 12.0 and 7.2 and frequency values of 15.0 and 24.0 percent, respectively. Serviceberry *(Amelanchier pallida)*, bitterbrush *(Purshia tridentata)*, rubber rabbitbrush *(Chrysothamnus nauseosus)* and slenderbrush eriogonum *(Eriogonum macrothecum)* are sparse in the community.

Cheatgrass *(Bromus tectorum)* is the most frequent grass with 57.0 percent. Squirreltail *(Sitanion hystrix)* and prairie junegrass *(Koeleria cristata)* are found in small quantities (3.0 and 1.5 percent frequency, respectively).

Astragalus sp., mat eriogonum *(Eriogonum caespitosum)*, longleaf phlox *(Phlox longifolia)* and specklepod locoweed *(Astragalus lentiginosus)* occur with small frequency percents (3.0, 2.5, 1.5 and 1.0, respectively)(Table 35). This community is probably a seral representative of a *Juniperus osteosperma/Pinus monophylla/Quercus gambelii/Amelanchier pallida/Koeleria cristata* habitat-type.

Litter accounts for 53.0 percent of the non-living ground cover, pavement for 35.5 percent, bare ground for 6.5 percent and rock for 5.0 percent (Table 36).

The soils at the macroplots where this community was sampled are members of a fine, mixed, frigid family of Mollic Haplargids (Appendix B-14); or fine, mixed, frigid family of Pachic Argixerolls (Appendix B-22).

Table 35. Species Density, Cover and Frequency for the *Juniperus osteosperma/Pinus monophylla/Quercus gambelii/Artemisia tridentata* Community

Species	Density**	Cover %	20 x 20* Frequency %
Juniperus osteosperma	55.0	14.8	-
Pinus monophylla	45.0	2.4	-
Quercus gambelii		12.0	15.0
Artemisia tridentata		7.2	24.0
Amelanchier pallida			5.0
Purshia tridentata			1.0
Chrysothamnus nauseosus			t***
Eriogonum microthecum			t
Bromus tectorum			57.0
Sitanion hystrix			3.0
Koeleria cristata			1.5
Astragalus sp.			3.0
Eriogonum caespitosum			2.5
Phlox longifolia			1.5
Astragalus lentiginosus			1.0

* Frame size in inches
** Trees/acre
*** Trace

Table 36. Non-living Ground Cover for the *Juniperus osteosperma/Pinus monophylla/Quercus gambelii/ Artemisia tridentata* Community

Material	Cover %
Bare ground	6.5
Litter	53.0
Pavement	35.5
Rock	5.0

Pinyon(*Pinus monophylla*) Communities

1. *Pinus monophylla/Amelanchier pallida/Arctostophylos patula* Community

This community is found on mountain slopes in the eastern part of Mathews Canyon Watershed. Inclusions of *Artemisia tridentata/Chrysothamnus nauseosus* occur within this community.

The community occurs on northwest facing slopes of 11 percent, elevation is around 5750 feet, and the mean annual precipitation is 15.9 inches (Appendix A).

Pinyon *(Pinus monophylla)* is the dominant species with a density of 585.0 trees per acre and 40.4 percent cover.

A number of shrubs are found in the community with serviceberry *(Amelanchier pallida)* and greenleaf manzanita *(Arctostophylos patula)* the most abundant. Respectively, they account for 5.9 and 5.8 percent cover, and 26.5 and 25.0 percent frequency.

Stansbury phlox *(Phlox stansburyi)* occurs with 1.0 percent frequency (Table 37). This community is probably a *(Pinus monophylla/Amelanchier pallida* habitat-type.

Litter accounts for 55.0 percent of the non-living ground cover, pavement for 34.0 percent, rock for 6.0 percent, and bare ground for 5.0 percent (Table 38).

The soil at the macroplot where this community was sampled is a member of a fine-loamy, mixed, frigid, shallow family of Entic Haploxerolls (Appendix B-25).

Table 37. Species Density, Cover and Frequency of the *Pinus monophylla/Amelanchier pallida/Arctostophylos patula* Community

Species	Density**	Cover %	20 x 20* Frequency %
Pinus monophylla	585.0	40.4	-
Amelanchier pallida		5.9	26.5
Arctostaphylos patula		5.8	25.0
Artemisia nova		1.4	4.5
Quercus gambelii		0.8	6.5
Purshia tridentata			1.0
Artemisia tridentata			0.5
Phlox stansburyi			1.0

* Frame size in inches
** Trees/acre

Table 38. Non-living Ground Cover for the *Pinus monophylla/Amelanchier pallida/Arctostophylos patula* Community

Material	Cover %
Bare ground	5.0
Litter	55.0
Pavement	34.0
Rock	6.0

2. *Pinus monophylla/Amelanchier pallida/Quercus gambelii* Community

This community occurs mostly in the southern part of Pine Canyon Watershed, but is also found in the northeast part of Mathews Canyon Watershed.

The community occurs on southeast or west facing slopes of 12 to 59 percent, elevation ranges from 5700 to 6400 feet, and the mean annual precipitation is 18.1 inches (Appendix A).

Pinyon *(Pinus monophylla)* is the dominant species with a density of 214.4 trees per acre and 22.5 percent cover. Juniper *(Juniperus osteosperma)* and ponderosa pine seedlings *(Pinus ponderosa)*, when present, occur with 5.0 and 1.0 trees per acre and 1.2 and trace percent cover.

Serviceberry *(Amelanchier pallida)*, Gambel oak *(Quercus gambelii)* and big sagebrush *(Artemisia tridentata)* are the most characteristic shrubs. Respectively, they account for 7.8, 4.3, and 2.5 percent cover, and 26.1, 17.1 and 8.6 percent frequency. Longflower snowberry *(Symphoricarpos longiflorus)*, yellowbrush *(Chrysothamnus viscidiflorus)* and bitterbrush *(Purshia tridentata)*, when present, occur in small quantities.

A number of grasses occur erratically through the community. Squirreltail *(Sitanion hystrix)*, Nevada bluegrass *(Poa nevadensis)* and prairie junegrass *(Koeleria cristata)* are most frequent (5.0, 4.8 and 1.8 percent, respectively).

A variety of forbs is found with constancy ratings that range from 25 to 75 percent. *Lathyrus sulphureus* and longleaf phlox *(Phlox longifolia)* are the most frequent with 5.5 and 2.8 percent (Table 39). This community is probably a seral representative of a *Pinus monophylla/Amelanchier pallida/Quercus gambelii/Poa nevadensis* habitat-type.

Litter accounts for 59.6 percent of the non-living ground cover, rock for 17.0 percent, pavement for 12.9 percent, and bare ground for 10.5 percent (Table 40).

The soils at the macroplots where this community was sampled are members of a fine, mixed, frigid family of Mollic Haplargids (Appendix B-14), or coarse-loamy, mixed, frigid family of Entic Haploxerolls (Appendix B-24).

Table 39. Species Density, Cover, Frequency and Constancy for the *Pinus monophylla/Amelanchier pallida/Quercus gambelii* Community

Species	Density**	Cover %	20 x 20* Frequency %	Constancy %
Pinus monophylla	214.4	22.5	-	100
Juniperus osteosperma	5.0	1.2		25
Pinus ponderosa (seedlings)	1.0	t***		25
Amelanchier pallida		7.8	26.1	100
Quercus gambelii		4.3	17.1	100
Artemisia tridentata		2.5	8.6	100
Symphoricarpos longiflorus			2.2	50
Chrysothamnus viscidiflorus				25
Purshia tridentata				25
Sitanion hystrix			5.0	75
Poa nevadensis			4.8	50
Koeleria cristata			1.8	25
Bouteloua gracilis				50
Bromus tectorum				50
Oryzopsis hymenoides				25
Lathyrus sulphureus			5.5	75
Phlox longifolia			2.8	50
Comandra pallida			1.9	75
Lupinus caudatus			1.5	75
Arabis holboellii			1.0	50
Delphinium andersonii			1.0	50
Phlox diffusa			1.0	50
Erigeron bloomeri				75
Aster scopulorum				50
Allium acuminatum				25
Astragalus purshii				25
Eriogonum sp.				25
Eriogonum thomasii				25
Gilia sinuata				25
Ipomopsis aggregata				25
Penstemon kingii				25
Paeonia sp.				25
Streptanthus cordatus				25
Trifolium macilentum				25

* Frame size in inches
** Trees/acre
*** Trace

Table 40. Non-living Ground Cover for the *Pinus monophylla/ Amelanchier pallida/Quercus gambelii* Community

Material	Cover %
Bare ground	10.5
Litter	59.6
Pavement	12.9
Rock	17.0

Pinyon and Juniper *(Pinus monophylla* and *Juniperus osteosperma)* Community

1. *Pinus monophylla/Juniperus osteosperma/Artemisia nova/ Amelanchier pallida* Community

This community has developed on mountains, ridges and undulating slopes in the southern part of Pine Canyon Watershed and eastern part of Mathews Canyon Watershed.

The community occurs on all aspects with 2 to 29 percent slope, elevation ranges from 5900 to 6750 feet, and the mean annual precipitation is 18.1 inches (Appendix A).

Pinyon *(Pinus monophylla)* and juniper *(Juniperus osteosperma)* are codominant species with an average density of 353.0 and 69.0 trees per acre, and 28.5 and 20.2 percent cover.

Black sagebrush *(Artemisia nova)*, serviceberry *(Amelanchier pallida)* and Gambel oak *(Quercus gambelii)* are the most abundant shrubs. Respectively, they account for 7.0, 6.2 and 4.3 percent cover and 26.3, 13.9 and 6.9 percent frequency. Yellowbrush *(Chrysothamnus viscidiflorus)*, big sagebrush *(Artemisia tridentata)*, plains pricklypear *(Opuntia polyacantha)* and bitterbrush *(Purshia tridentata)*, when present, occur in small quantities.

A variety of grasses occur erratically (20 to 60 percent constancy) through the community. The most frequent are cheatgrass *(Bromus tectorum)*, prairie junegrass *(Koeleria cristata)* and fluffgrass *(Tridens pulchellus)* with 9.3, 5.1 and 4.6 percent, respectively.

A large number of forbs are found with constancy ratings of 20 to 40 percent. The most frequent are *Gilia sinuata* and bastard toadflax *(Comandra pallida)* with 10.0 and 9.1 percent, respectively (Table 41). This community is probably a *Pinus monophylla/Juniperus osteosperma/ Amelanchier pallida/Artemisia nova* habitat-type.

Litter accounts for 61.0 percent of the non-living ground cover, pavement for 25.7 percent, rock for 11.0 percent and bare ground for 2.3 percent (Table 42).

The soils at the macroplots where this community was sampled are members of a fine, mixed, frigid, shallow family of Mollic Haplargids (Appendix B-10); fine,mixed, frigid family of Mollic Haplargids (Appendix B-14); or fine, mixed, frigid family of Lithic Haplargids (Appendix B-26).

Table 41. Species Density, Cover, Frequency and Constancy for the *Pinus monophylla/Juniperus osteosperma/Artemisia nova/Amelanchier pallida* Community

Species	Density**	Cover %	20 x 20* Frequency %	Constancy %
Pinus monophylla	353.0	28.5		100
Juniperus osteosperma	69.0	20.2		100
Artemisia nova		7.0	26.3	100
Amelanchier pallida		6.2	12.9	100
Quercus gambelii		4.3	6.9	80
Chrysothamnus viscidiflorus			3.1	40
Artemisia tridentata				60
Opuntia polyacantha				20
Purshia tritentata				20
Bromus tectorum			9.3	60
Koeleria cristata			5.1	40
Tridens pulchellus			4.7	40
Poa secunda			1.7	40
Sitanion hystrix				40
Poa fendleriana				20
Poa nevadensis				40
Gilia sinuata			10.0	20
Comandra pallida			9.1	20
Arabis sp.			3.0	40
Lomatium leptocarpum			1.8	20
Zigadenus paniculatus			1.6	20
Phlox longifolia			1.4	40
Allium acuminatum			1.0	20
Agroseris glauca				20
Arabis holboellii				20
Astragalus lentiginosus				20
Balsamorhiza hookeri				20
Erigeron bloomeri				20
Delphinium andersonii				20
Eriogonum thomasii				20
Fritillaria atropurpurea				20
Lithophragma bulbifera				20

* Frame size in inches
** Trees/acre

Table 42. Non-living Ground Cover for the *Pinus monophylla/Juniperus osteosperma/Artemisia nova/Amelanchier pallida* Community

Material	Cover %
Bare ground	2.3
Litter	61.0
Pavement	25.7
Rock	11.0

Ponderosa Pine *(Pinus ponderosa)* Communities

1. *Pinus ponderosa/Chrysothamnus nauseosus/ Bromus tectorum* Community

This community has developed in the main drainages of the Pine Canyon Watershed.

The community occurs on north or northwest facing slopes of 1 to 5 percent, elevation ranges from 5600 to 5900 feet, and the mean annual precipitation is 16.6 inches (Appendix A).

Ponderosa pine *(Pinus ponderosa)* is the dominant species with 32.5 trees per acre and 19.5 percent cover. Juniper *(Juniperus osteosperma)*, when present, has an average density of 4.2 trees per acre and trace cover percentage.

Rubber rabbitbrush *(Chrysothamnus nauseosus)* and big sagebrush *(Artemisia tridentata)* occur with 10.6 and 2.5 percent cover, and 19.9 and 9.9 percent frequency.

Cheatgrass *(Bromus tectorum)* and squirreltail *(Sitanion hystrix)* have constancy ratings of 100 percent and frequency percents of 59.4 and 4.8, respectively. Crested wheatgrass *(Agropyron desertorum)*, bluestem wheatgrass *(Agropyron smithii)*, and Sandberg bluegrass *(Poa secunda)* occur with 25 percent constancy and frequency values of 4.8, 1.1 and 1.0 percent, respectively.

The most frequent forbs are bastard toadflax *(Comandra pallida)* and *Gilia sinuata* with 23.5 and 7.2 percent. Respectively their constancy percentages are 100 and 50. Additional forbs have constancy ratings of 20 to 50 percent and low frequency values (Table 43). This community is probably a seral representative of a *Pinus ponderosa/ Artemisia tridentata/Agropyron smithii* habitat-type.

Litter accounts for 69.6 percent of the non-living ground cover, bare ground for 28.4 percent, rock for 1.5 percent and pavement for 0.5 percent (Table 44).

The soils at the macroplots where the community was sampled are members of coarse-loamy, mixed, mesic family of Xerofluvents (Appendix B-1).

Table 43. Species Density, Cover, Frequency and Constancy for the *Pinus ponderosa/Chrysothamnus nauseosus/ Bromus tectorum* Community

Species	Density**	Cover %	20 x 20* Frequency %	Constancy %
Pinus ponderosa	32.5	19.5	-	100
Juniperus osteosperma	4.2	t***	-	25
Chrysothamnus nauseosus		10.6	19.9	100
Artemisia tridentata		2.5	9.9	100
Bromus tectorum			59.4	100
Agropyron desertorum			4.8	25
Sitanion hystrix			1.2	100
Agropyron smithii			1.1	25
Poa secunda			1.0	25
Comandra pallida			23.5	100
Gilia sinuata			7.2	50
Descurainia sophia			1.2	25
Allium acuminatum			1.0	50
Astragalus purshii				25
Chaenactis douglasii				25
Chenopodium leptophyllum				25
Lappula redowskii				25
Lepidium montanum				25
Lupinus caudatus				25
Phlox longifolia				25

* Frame size in inches

** Trees/acre

*** Trace

Table 44. Non-living Ground Cover for the *Pinus ponderosa/ Chrysothmanus nauseosus/Bromus tectorum* Community

Material	Cover %
Bare ground	28.4
Litter	69.6
Pavement	0.5
Rock	1.5

2. *Pinus ponderosa/Quercus gambelii* Community

This community occurs on mountain slopes in the southern part of Pine Canyon Watershed.

The community occurs on north and east facing slopes of 11 to 16 percent, elevation ranges from 6000 to 6750 feet, and the mean annual precipitation is 19.1 inches (Appendix A).

Ponderosa pine *(Pinus ponderosa)* is the dominant species with an average density of 88.0 trees per acre and 18.9 percent cover.

Gambel oak *(Quercus gambelii)* is the most abundant shrub with 11.6 percent cover and 43.4 percent frequency. Longleaf snowberry *(Symphoricarpos longiflorus)*, serviceberry *(Amelanchier pallida)* and big sagebrush *(Artemisia tridentata)* occur with constancy percents of 100, 100 and 80 and frequency percents of 10.3, 9.8 and 5.2, respectively. A few additional shrubs occur with 20 percent constancy and low frequency values.

Squirreltail *(Sitanion hystrix)*, cheatgrass *(Bromus tectorum)*, Nevada bluegrass *(Poa nevadensis)*, and crested wheatgrass *(Agropyron desertorum)* have frequency values of 3.6, 1.8, 1.8 and trace percent, and constancy ratings of 80, 100, 80 and 20 percent, respectively.

Sedge *(Carex* sp.) is present in most stands (80 percent constancy) with 5.8 percent frequency. *Gilia sinuta*, Utah clover *(Trifolium macilentum)*, woodland star *(Lithophragma bulbifera)*, peony *(Paeonia* sp.), bloomer fleabane *(Erigeron bloomeri)* and bicolor biscuitroot *(Lomatium leptocarpum)* are the most frequent forbs with 9.7, 6.3, 5.3, 4.3, 4.2 and 3.6 percent, respectively. A number of other forbs are found with low frequency values and varied constancy ratings (Table 45). This community is probably a *Pinus ponderosa/Symphoricarpos longiflorus/Poa nevadensis* habitat-type.

Litter accounts for 85.1 percent of the non-living ground cover, rock for 10.5 percent, bare ground for 2.4 and pavement for 2.0 percent (Table 46).

The soils at the macroplots where this community was sampled are members of a fine, mixed, frigid family of Typic Argixerolls (Appendix B-18); or coarse-loamy, mixed, frigid family of Entic Haploxerolls (Appendix B-24).

Table 45. Species Density, Cover, Frequency and Constancy for the *Pinus ponderosa/Quercus gambelii* Community

Species	Density**	Cover %	20 x 20* Frequency %	Constancy %
Pinus ponderosa	88.0	18.9	-	100
Quercus gambelii		11.6	43.4	100
Symphoricarpos longiflorus			10.3	100
Amelanchier pallida			9.8	100
Artemisia tridentata			5.2	80
Artemisia nova			1.3	20
Opuntia polyacantha				20
Sitanion hystrix			3.6	80
Bromus tectorum			1.8	100
Poa nevadensis			1.8	80
Agropyron desertorum				20
Carex sp.			5.8	80
Gilia sinuta			9.7	80
Trifolium macilentum			6.3	100
Lithophragma bulbifera			5.3	80
Paeonia sp.			4.3	100
Erigeron bloomeri			4.2	100
Lomatium leptocarpum			3.6	100
Lathyrus sulphureus			3.1	60
Allium acuminatum			2.7	20
Agoseris glauca			1.7	80
Arabis holboellii			1.6	80
Delphinium andersonii			1.6	80
Fritillaria atropurpurea				60
Astragalus lentiginosus				40
Lupinus caudatus				40
Zigadenus paniculatus				40
Chaenactis douglasii				20
Penstemon kingii				20

* Frame size in inches
** Trees/acre

Table 46. Non-living Ground Cover for the *Pinus ponderosa/Quercus gambelii* Community

Material	Cover %
Bare ground	2.4
Litter	85.1
Pavement	2.0
Rock	10.5

Desert peach *(Prunus fasciculata)* Community

1. *Prunus fasciculata/Quercus turbinella/ Bromus tectorum* Community

This community has resulted mostly from burning the *Juniperus osteosperma/Artemisia tridentata/Sitanion hystrix* community. It is found in the southwest part of Mathews Canyon Watershed.

The community occurs on southwest facing slopes of 25 percent, elevation is around 6125 feet, and the mean annual precipitation is 16.7 inches (Appendix A).

Desert peach *(Prunus fasciculata)* and desert live oak *(Quercus turbinella)* are the most dominant species with 6.6 and 4.5 percent cover, and 15.5 and 34.5 percent frequency. Serviceberry *(Amelanchier pallida)*, greenleaf manzanita *(Arctostaphylos patula)*, big sagebrush *(Artemisia tridentata)* and yellowbrush *(Chrysothamnus viscidiflorus)* respectively have 2.0, 2.0, 1.5 and 1.0 percent frequency.

Cheatgrass *(Bromus tectorum)* is the most frequent grass (93.5 percent). Crested wheatgrass *(Agropyron desertorum)*, sixweeks fescue *(Festuca octoflora)* and squirreltail *(Sitanion hystrix)* are found with frequency values of 3.5, 2.5 and 1.0 percent.

Eriodictyon angustifolium, *Astragalus* sp., and scarlet globemallow *(Sphaeralcea coccinea)* occur with 7.5, 2.0 and 2.0 percent frequency, respectively (Table 47). This community is probably a *Juniperus osteosperma/Artemisia tridentata/Bouteloua gracilis* habitat-type.

Pavement accounts for 46.0 percent of the non-living ground cover, litter for 35.0 percent, rock for 10.5 percent, and bare ground for 8.5 percent (Table 48).

The soil at the macroplot where this community was sampled is a member of a loamy-skeletal, mixed, frigid family of Typic Argixerolls (Appendix B-15).

Table 47. Species Cover and Frequency for the *Prunus fasciculata/Quercus turbinella/Bromus tectorum* Community

Species	Cover %	20 x 20* Frequency %
Prunus fasciculata	6.6	15.5
Quercus turbinella	4.5	34.5
Amelanchier pallida		2.0
Arctostaphylos patula		2.0
Artemisia tridentata		1.5
Chrysothamnus viscidiflorus		1.0
Bromus tectorum		93.5
Agropyron desertorum		3.5
Festuca octoflora		2.5
Sitanion hystrix		1.0
Eriodictyon angustifolium		7.5
Astragalus sp.		2.0
Sphaeralcea coccinea		2.0

*Frame size in inches

Table 48. Nonliving Ground Cover for the *Prunus fasciculata/Quercus turbinella/Bromus tectorum* Community

Material	Cover %
Bare ground	8.5
Litter	35.0
Pavement	46.0
Rock	10.5

Gambel Oak *(Quercus gambelii)* Community

1. *Quercus gambelii/Amelanchier pallida* Community

This community occurs on mountain slopes in the southern part of Pine Canyon Watershed and in the south and eastern part of Mathews Canyon Watershed.

The community is found on north facing slopes of 11 to 22 percent, elevation ranges from 6000 to 6400 feet, and the mean annual precipitation is 18.4 inches (Appendix A).

Gambel oak *(Quercus gambelii)*, serviceberry (*Amelanchier pallida)*, greenleaf manzanita *(Arctostaphylos patula)*, and big sagebrush *(Artemisia tridentata)* have constancy ratings of 100 percent. Respectively, they account for 20.1, 6.1, 3.6 and 1.8 percent cover, and 60.0, 34.7, 3.8 and 18.2 percent frequency. Snowberry *(Symphoricarpos* sp.), black sagebrush *(Artemisia nova)*, bitterbrush *(Purshia tridentata)* and longleaf snowberry *(Symphoricarpos longiflorus)* are found with 50 percent constancy and low frequency percentages.

Prairie junegrass *(Koeleria cristata)*, cheatgrass *(Bromus tectorum)* and squirreltail *(Sitanion hystrix)* Occur with 50 percent constancy and low frequency values.

All forbs have a 50 percent constancy rating and low frequency percentages. *Lupinus* sp. and longleaf phlox *(Phlox longifolia)* are the most frequent with 3.5 and 1.8 percent (Table 49). This community is probably a *Quercus gambelii/Amelanchier pallida* habitat-type.

Litter accounts for 60.5 percent of the non-living ground cover, rock for 16.5 percent, pavement for 14.5 percent and bare ground for 9.5 percent (Table 50).

The soils at the macroplots where this community was sampled are members of a loamy-skeletal, mixed, frigid family of Lithic Mollic Haplargids (Appendix B-8); or coarse-loamy, mixed, frigid family of Entic Haploxerolls (Appendix B-24).

Table 49. Species Cover, Frequency and Constancy for the *Quercus gambelii/Amelanchier pallida* Community

Species	Cover %	20 x 20* Frequency %	Constancy %
Quercus gambelii	20.1	60.0	100
Amelanchier pallida	6.1	34.7	100
Arctostaphylos patula	3.6	3.8	100
Artemisia tridentata	1.8	18.2	100
Symphoricarpos sp.		6.2	50
Artemisia nova		4.8	50
Purshia tridentata			50
Symphoricarpos longiflorus			50
Koeleria cristata		2.5	50
Bromus tectorum		1.2	50
Sitanion hystrix			50
Lupinus sp.		3.5	50
Phlox longifolia		1.8	50
Arabis sp.		1.0	50
Vicia sp.		1.0	50
Astragalus sp.			50
Eriogonum sp.			50
Eriogonum jamesii			50
Galium matthewsii			50
Ipomopsis aggregata			50
Penstemon palmeri			50

* Frame size in inches

Table 50. Non-living Ground Cover for the *Quercus gambelii/Amelanchier pallida* Community

Material	Cover %
Bare ground	9.5
Litter	60.5
Pavement	14.5
Rock	15.5

DISCUSSION

Management Areas

Livestock grazing in most communities has been associated with depletion of the more palatable grass and browse stands, and the invasion or increase of undesirable plants. The result has been an apparent decrease in cover and frequency of the more desirable forage species.

In an attempt to improve the condition of Pine Canyon and Mathews Canyon Watersheds, livestock and wildlife production, and recreation, the Bureau of Land Management has chained pinyon-juniper and seeded, plowed big sagebrush communities and seeded, developed water, and started to regulate cattle numbers and grazing use.

Range Rehabilitation and Improvements: In addition to those communities already treated, the *Artemisia tridentata/Chrysothamnus nauseosus* community in the drainage bottoms and on the more gentle fans mostly in the northern part of the watersheds, and the *Chrysothamnus nauseosus/Artemisia tridentata* community can be treated. These two communities receive 15.3 inches of precipitation and have a low rock cover.

The soils are coarse-loamy, mixed, mesic family of Typic Xerofluvents, fine-loamy, mixed, frigid family of Pachic Argixerolls and coarse-loamy, mixed, mesic family of Typic Haploxerolls with profile available water holding capacities of 2.6 and 6.5 inches. These vegetation-soil units should be plowed and seeded with a mixture of grasses, forbs and shrubs.

The *Juniperus osteosperma*, *Juniperus osteosperma/Artemisia nova*, *Juniperus osteosperma/Artemisia tridentata/Bromus tectorum*, *Juniperus osteosperma/Artemisia tridentata/Poa secunda*, *Juniperus osteosperma/Artemisia tridentata/Sitanion hystrix*, and *Juniperus osteosperma/Pinus monophylla* communities occur on the more gentle slopes in the watersheds (1 to 22 percent). The soils family found associated with these communities are: Loamy-skeletal, mixed, mesic family of Typic Torriorthents; loamy, mixed mesic family of Lithic Torriorthents; coarse-loamy, mixed,mesic family of Mollic Durorthids; fine, mixed, mesic family of Mollic Durargids; fine, mixed, mesic family of Duric Mollic Haplargids; loamy-skeletal, mixed, frigid family of Mollic Haplargids; clayey-skeletal, mixed, mesic family of Mollic Haplargids; fine-mixed, mesic family of Mollic Haplargids; fine, mixed, frigid family of Mollic Haplargids; fine, mixed, mesic family of Typic Argixerolls; and fine, mixed, mesic family of Duric Argixerolls with profile available water holding capacities of 1.9 to 7.1 inches. The mean annual precipitation ranges from 15.1 to 17.7 inches. These communities, if treated, should be chained in two directions with a mixture of grasses, forbs and shrubs aerial broadcast between chainings.

Management by Grazing: The two watersheds should be placed under a grazing management system such as rest-rotation. This would make sure the improvements would maintain themselves and the watershed condition as a whole would improve.

Ecological Interpretations

A few of the communities in the watersheds are in pristine condition (Table 51) while most are seral. Plant communities and their associated soil families are discussed below (Appendix C).

In the eastern part of Mathews Canyon Watershed on nearly level slopes, the *Artemisia nova/Bromus tectorum* community has developed. It occurs on soils with a 2 to 10-inch light brownish gray ochric epipedon over a strong medium prismatic, clay argillic horizon and is classified as a mollic intergrade. This community is probably a seral representative of an *Artemisia nova/Bouteloua gracilis* habitat-type where *B. gracilis* has decreased due to grazing and *Bromus tectorum* has invaded and increased to its present status in the community.

The *Artemisia tridentata/Agropyron desertorum* community occurs in the western part of Mathews Canyon Watershed on undulating fans. It has resulted from plowing and seeding the *Juniperus osteosperma/Artemisia tridentata/Sitanion hystrix* community. The community is found on soils with a 2 to 10-inch light brownish gray ochric epipedon over a strong medium prismatic, clay argillic horizon and is a mollic intergrade. This community is probably a seral representative of a *Juniperus osteosperma/Artemisia tridentata/Bouteloua gracilis* habitat-type.

As inclusions within the pinyon and juniper dominated communities or in drainage bottoms in both Pine Canyon and Mathews Canyon Watersheds the *Artemisia tridentata/Chrysothamnus nauseosus* community is found. It occurs on soils with a 20-inch mollic epipedon over a moderate fine subangular blocky, sandy clay loam argillic horizon, or a 10 to 16-inch mollic epipedon over a weak coarse prismatic, silt loam cambic horizon. This community is probably an *Artemisia tridentata/Elymus cinereus* habitat-type.

The *Artemisia tridentata/Lupinus caudatus* community occurs on gently sloping fans in the western part of Mathews Canyon Watershed. It has resulted from burning the *Juniperus osteosperma/Pinus monophylla* community. It is found on soils with a 7-inch light brownish gray ochric epipedon over a subangular blocky, fine-loamy argillic horizon with a weakly cemented duripan within 24 inches of the surface and is classified as a mollic intergrade. This community is probably a seral representative of a *Juniperus osteosperma/Pinus monophylla* habitat-type.

In front of the Pine Canyon and Mathews Canyon dams, where the vegetation was disturbed for the reservoirs or elsewhere as small inclusions, the *Chrysothamnus nauseosus/Artemisia tridentata* community is located. It occurs on soils with a 2 to 19-inch ochric epipedon over a massive, loamy sand IICl horizon, or a 10 to 16-inch mollic epipedon over a weak coarse prismatic, silt loam cambic horizon. This community is probably an *Artemisia tridentata/Elymus cinereus* habitat-type.

On terraces and slopes in the northern part of Pine Canyon and Mathews Canyon Watersheds, the *Juniperus osteosperma* community has developed. It is found on soils with a 6-inch ochric epipedon over a moderate medium subangular blocky, silt loam B2 cambic horizon with an indurated duripan within 24 inches of the surface and is a mollic intergrade; a 1 to 6-inch ochric epipedon over a strong medium prismatic, clay argillic horizon with an indurated duripan with 13 to 37-inches of the surface and is classified as a mollic intergrade; a 2 to 10-inch light brownish gray ochric epipedon over a strong medium prismatic, clay argillic horizon and is a mollic intergrade; or a 27-inch mollic epipedon over a moderate medium prismatic to massive, gravelly clay argillic horizon. This community is probably a *Juniperus osteosperma* habitat-type.

The *Juniperus osteosperma/Artemisia nova* community occurs on slopes and terraces mostly in the northwest and central part of Mathews Canyon Watershed and to a small extent in Pine Canyon Watershed. It occurs on soils with an 8 to 9-inch ochric epipedon over a massive, sandy loam C1 horizon, or a 5-inch light brownish gray ochric epipedon over a strong medium subangular blocky to massive, very gravelly clay argillic horizon that is a mollic intergrade. This community is probably a seral representative of a *Juniperus osteosperma/Artemisia nova/Bouteloua gracilis* habitat-type.

On slopes and terraces in the northwest and northeast part of Pine Canyon Watershed, the *Juniperus osteosperma/Artemisia tridentata/Agropyron desertorum* community has developed. It has resulted from chaining and seeding the *Juniperus osteosperma/Artemisia tridentata/Sitanion hystrix* or *Juniperus osteosperma/Artemisia tridentata/Poa secunda* communities. This community occurs on soils with a 1 to 6-inch ochric epipedon over a strong medium prismatic clay argillic horizon with an indurated duripan within 13 to 37-inches of the surface and is a mollic intergrade; or a 2 to 10-inch light brownish gray ochric epipedon over a strong medium prismatic, clay argillic horizon and is classified as a mollic intergrade. It is probably a seral representative of a *Juniperus osteosperma/Artemisia tridentata/Bouteloua gracilis* habitat-type.

The *Juniperus osteosperma/Artemisia tridentata/Bromus tectorum* community occurs on slopes in the northeast part of Mathews Canyon Watershed. It is found on soils with a 2 to 10-inch light brownish gray ochric epipedon over a strong medium prismatic, clay argillic horizon. It is probably a seral representative of a *Juniperus osteosperma/Artemisia tridentata/Bouteloua gracilis* habitat-type.

The *Juniperus osteosperma/Artemisia tridentata/Cowania stansburiana/Bouteloua gracilis* community has developed on slopes in the northwest part of Mathews Canyon Watershed. It occurs on soils with an 8 to 9-inch ochric epipedon over a massive, sandy loam C1 horizon. It is probably a *Juniperus osteosperma/Cowania stansburiana/Artemisia tridentata/Bouteloua gracilis* habitat-type.

The *Juniperus osteosperma/Artemisia tridentata/Hilaria jamesii* community is found on slopes in the northwest part of Mathews Canyon Watershed. It occurs on soils with a 1 to 6-inch ochric epipedon over a strong medium prismatic, clay argillic horizon with an indurated duripan within 13 to 37-inches of the surface and is a mollic intergrade. This community is probably a *Juniperus osteosperma/Artemisia tridentata/Hilaria jamesii* habitat-type.

The *Juniperus osteosperma/Artemisia tridentata/Poa secunda* community has developed on hills and mountains in the northern part of Pine Canyon Watershed. It occurs on soils with a 10-inch light brownish gray ochric epipedon over a massive, loamy sand C horizon, or a 1 to 6-inch ochric epipedon over a strong medium prismatic, clay argillic horizon with an indurated duripan within 13 to 37-inches of the surface and is a mollic intergrade. This community is probably a seral representative of a *Juniperus osteosperma/Artemisia tridentata/Bouteloua gracilis* habitat-type.

The *Juniperus osteosperma/Artemisia tridentata/Sitanion hystrix* community is located in the north, central and western part of Mathews Canyon Watershed and in the northern part of Pine Canyon Watershed on undulating slopes, hills and mountains. It occurs on soils with a 1 to 16-inch ochric epipedon over a strong medium prismatic, clay argillic horizon with an indurated duripan within 13 to 37-inches of the surface and is classified as a mollic intergrade; a 2 to 10-inch light brownish gray ochric epipedon over a strong medium prismatic, clay argillic horizon and is a mollic intergrade; a 10-inch mollic epipedon over a strong fine subangular blocky to massive, clay argillic horizon; or a 9 to 18-inch mollic epipedon over a moderate to strong medium prismatic, clay argillic horizon, and an indurated duripan within 23 inches of the surface. This community is probably a *Juniperus osteosperma/Artemisia tridentata/Bouteloua gracilis* habitat-type.

The *Juniperus osteosperma/Pinus monophylla* community is found mostly in the central part of Pine Canyon Watershed with a small amount in the western part of Mathews Canyon Watershed. It occurs on soils with a 2-inch ochric epipedon over a moderate medium prismatic, clay argillic horizon with durinodes within 27 inches of the surface and is a mollic intergrade; a 2 to 5-inch light brownish gray ochric epipedon over a moderate fine subangular blocky, very gravelly sandy clay loam argillic horizon and is a mollic intergrade; a 2 to 10-inch light brownish gray ochric epipedon over a strong medium prismatic, clay argillic horizon and is classified as a mollic intergrade; or a 6 to 14-inch light brownish gray ochric epipedon over a moderate medium subangular blocky, clay argillic horizon and is a mollic intergrade. This community is probably a *Juniperus osteosperma/Pinus monophylla* habitat-type.

On ridges in the south central part of Pine Canyon Watershed, the *Juniperus osteosperma/Pinus monophylla/Artemisia nova* community has developed. It occurs on soils with a 2 to 10-inch light brownish gray ochric epipedon over a strong medium prismatic, clay argillic horizon and is classified as a mollic intergrade. This community is probably a *Juniperus osteosperma/Pinus monophylla/Artemisia nova/Bouteloua gracilis* habitat-type.

The *Juniperus osteosperma/Pinus monophylla/Artemisia tridentata/ Amelanchier pallida* community is located on mountain slopes in the western part of Pine Canyon Watershed and in the southern part of Mathews Canyon Watershed. It occurs on soils with a 5-inch ochric epipedon over a moderate fine subangular blocky, very gravelly clay argillic horizon with lithic contact within 16-inches of the surface and is classified as a mollic intergrade; or a 19-inch mollic epipedon over a strong fine subangular blocky to massive, gravelly clay argillic horizon and paralithic contact within 19-inches of the surface. This community is probably a *Juniperus osteosperma/Pinus monophylla/ Amelanchier pallida/Purshia tridentata* habitat-type.

On ridges in the western and eastern part of Pine Canyon Watershed, the *Juniperus osteosperma/Pinus monophylla/Chrysothamnus viscidiflorus/Agropyron desertorum* community has developed. This has resulted from the chaining of juniper-pinyon communities and seeding. The community occurs on soils with a 2 to 10-inch light brownish gray ochric epipedon over a strong medium prismatic, clay argillic horizon and is classified as a mollic intergrade. This community is probably a *Juniperus osteosperma/Pinus monophylla* habitat-type.

In the northeast part of Mathews Canyon Watershed the *Juniperus osteosperma/Pinus monophylla/Quercus gambelii/Artemisia tridentata* community is encountered. It is found on soils with a 6 to 14-inch light brownish gray ochric epipedon over a moderate medium subangular blocky, clay argillic horizon and is a mollic intergrade; or a 33-inch mollic epipedon over a strong fine subangular blocky to massive, clay argillic horizon. This community is probably a seral representative of a *Juniperus osteosperma/Pinus monophylla/Quercus gambelii/Amelanchier pallida* habitat-type.

The *Pinus monophylla/Amelanchier pallida/Arctostophylos patula* community has developed on mountain slopes in the eastern part of Mathews Canyon Watershed. It occurs on soils with a 7-inch mollic epipedon over weathered shale that is within 8 inches of the surface. This community is probably a *Pinus monophylla/Amelanchier pallida* habitat-type.

The *Pinus monophylla/Amelanchier pallida/Quercus gambelii* community occurs mostly in the southern part of Pine Canyon Watershed but it is found also in the northeast part of Mathews Canyon Watershed. It is found on soils with a 6 to 14-inch light brownish gray ochric epipedon over a moderate medium subangular blocky, clay argillic horizon and is classified as a mollic intergrade. This community is probably a *Pinus monophylla/Amelanchier pallida/Quercus gambelii/Poa nevadensis* habitat-type.

On mountains, ridges and undulating slopes in the southern part of Pine Canyon Watershed and in the eastern part of Mathews Canyon Watershed, the *Pinus monophylla/Juniperus osteosperma/Artemisia nova/Amelanchier pallida* community is encountered. It occurs on soils with a 7 to 9-inch light brownish gray ochric epipedon over a moderate fine subangular blocky, clay argillic horizon and paralithic contact within 20 inches of the surface and is classified as a mollic intergrade; a 6 to 14-inch light brownish gray ochric epipedon over a moderate medium subangular blocky, clay argillic horizon and is a mollic intergrade; or a 12-inch mollic epipedon over lithic contact. This community is probably a seral representative of a *Pinus monophylla/Juniperus osteosperma/Amelanchier pallida/Artemisia nova* habitat-type.

In the main drainages of Pine Canyon Watershed, the *Pinus ponderosa/Chrysothamnus nauseosus/Bromus tectorum* community has developed. It occurs on soils with a 2 to 10-inch ochric epipedon over a massive, loamy sand IICl horizon. This community is probably a *Pinus ponderosa/Artemisia tridentata/Agropyron smithii* habitat-type where *Chrysothamnus nauseosus* has increased due to grazing.

The *Pinus ponderosa/Quercus gambelii* community is found on mountain slopes in the southern part of Pine Canyon Watershed. It occurs on soils with a 7-inch mollic epipedon over a moderate strong medium prismatic, clay argillic horizon, or a 10 to 16-inch mollic epipedon over a weak coarse prismatic, silt cambic horizon. This community is probably a *Pinus ponderosa/Symphoricarpos longiflorus/Poa nevadensis* habitat-type.

The *Prunus fasciculata/Quercus turbinella/Bromus tectorum* community has resulted mostly from burning the *Juniperus osteosperma/Artemisia tridentata/Sitanion hystrix* community. It occurs in the southwest part of Mathews Canyon Watershed on soils with a 10-inch ochric epipedon over a moderate medium subangular blocky, gravelly clay loam argillic horizon. This community is probably a seral representative of a *Juniperus osteosperma/Artemisia tridentata/Bouteloua gracilis* habitat-type.

On mountain slopes in the southern part of Pine Canyon Watershed and in the south and eastern part of Mathews Canyon Watershed, the *Quercus gambelii/Amelanchier pallida* community has developed. It occurs on soils with a 2-inch grayish brown ochric epipedon over a moderate fine subangular blocky, very gravelly clay loam argillic horizon with lithic contact within 10 inches of the surface and is a mollic intergrade; or a 8 to 12-inch mollic epipedon over a massive, weak red, sandy loam C1 horizon. It is probably a *Quercus gambelii/Amelanchier pallida* habitat-type.

Climaxes:

Climax as used in this report is defined as the kind of community capable of perpetuation under the prevailing climatic, edaphic, physiographic, biotic or pyric condition. This definition is in accordance with the polyclimax concept where several climaxes constitute the vegetation in an area as the result of succession.

Climatic climax developes on land (moderately rolling to level) that is neither excessively nor inadequately drained, so that the major environmental conditions affecting organisms are climatic. Physiographic climax is determined in large measure by the nature of the topography (land relief). Edaphic climax is determined largely by the nature of the soil. A physiographic-edaphic climax is determined mostly by both physiographic and soils. A biotic climax is determined by the incidence and maintenance of a decisive "biotic factor" such as the continuous heavy grazing by animals. Pyric climax is determined by any association that maintains its composition and structure only as a consequence of periodic burning (Hanson, 1962).

Most all of the communities in the watersheds have been affected by grazing use and areas of relatively undisturbed vegetation are not common. Consequently, a majority of the communities are biotic or pyric climaxes. For this reason an estimate of the climax of each community was based on their present condition and probable habitat-type (Table 51).

Recreation

The Watersheds are located fairly close to Caliente, Pioche, Panaca and Beaver Dam State Park. If more recreation development in the general area is felt necessary, Pine Canyon Watershed would be a suitable location. The basin has the advantage of several perennial springs and ponderosa pine that provide shade and excellent areas for camping and picnic grounds.

Both Pine Canyon and Mathews Canyon Watersheds are scenic and provide deer hunting. They are good areas for Pinyon Pine nut gathering and Christmas tree harvesting. The grandeur of the vegetation, topographic features, and wide open spaces may also attract a certain type of recreationist.

Table 51. Type of climaxes associated with the probable habitat-types and present biotic communities in the Pine Canyon and Mathews Canyon Watersheds

Probable Habitat-type and Biotic Communities	TYPE OF CLIMAX					
	Climatic	Physio-graphic	Edaphic	Physio-graphic-Edaphic	Biotic	Pyric
A[a] *Artemisia nova/Bouteloua gracilis*				X		
1[b] *A. nova/Bromus tectorum*					X	
B[a] *Artemisia tridentata/Elymus cinereus*			X			
1[b] *A. tridentata/Chrysothamnus nauseosus*					X	
2[b] *C. nauseosus/A. tridentata*					X	
C[ab] *Juniperus osteosperma*				X		
D[a] *J. osteosperma/A. nova/B. gracilis*				X		
1[b] *J. osteosperma/A. nova*					X	
E[a] *J. osteosperma/A. tridentata/B. gracilis*	X					
1[b] *A. tridentata/Agropyron desertorum*					X	
2[b] *J. osteosperma/A. tridentata/Agropyron desertorum*					X	
3[b] *J. osteosperma/A. tridentata/Bromus tectorum*					X	
4[b] *J. osteosperma/A. tridentata/Poa secunda*					X	
5[b] *J. osteosperma/A. tridentata/Sitanion hystrix*					X	
6[b] *Prunus fasciculata/Quercus turbenella/B. tectorum*						X
F[ab] *J. osteosperma/A. tridentata/Hilaria jamesii*		X				
G[a] *J. osteosperma/Cowania stansburiana/A. tridentata/B. gracilis*				X		
1[b] *J. osteosperma/A. tridentata/C. stansburiana/B. gracilis*					X	
H[ab] *J. osteosperma/Pinus monophylla*				X		
1[b] *A. tridentata/Lupinus caudatus*						X
2[b] *J. osteosperma/Chrysothamnus viscidiflorus/Agropyron desertorum*					X	

I[a]	*J. osteosperma/P. monophylla/A. nova/B. gracilis*				X		
	I[b] *J. osteosperma/P. monophylla/A. nova*					X	
J[a]	*J. osteosperma/P. monophylla/Amelanchier pallida/ Purshia tridentata*				X		
	I[b] *J. osteosperma/P. monophylla/A. tridentata/ A. pallida*					X	
K[a]	*J. osteosperma/P. monophylla/Q. gambelii/A. pallida/ Koeleria cristata*				X		
	I[b] *J. osteosperma/P. monophylla/Q. gambelii/ A. tridentata*					X	
L[a]	*P. monophylla/Amelanchier pallida*				X		
	I[b] *P. monophylla/A. pallida/Arctostophylos patula*					X	
M[a]	*P. monophylla/A. pallida/Q. gambelii/Poa nevadensis*				X		
	I[b] *P. monophylla/A. pallida/Q. gambelii*					X	
N[a]	*P. monophylla/J. osteosperma/A. pallida/A. nova*				X		
	I[b] *P. monophylla/J. osteosperma/A. nova/A. pallida*					X	
O[a]	*Pinus ponderosa/A. tridentata/Agropyron smithii*		X				
	I[b] *P. ponderosa/C. nauseosus/B. tectorum*					X	
P[a]	*P. ponderosa/Symphoricarpos longiflorus/Poa nevadensis*		X				
	I[b] *P. ponderosa/Q. gambelii*					X	
Q[ab]	*Quercus gambelii/Amelanchier pallida*				X		

a Habitat-type
b Community
ab Habitat-type and Community

Literature Cited

Cain, S. A. and G. M. Castro. 1959. Manual of vegetation analysis. Harper and Bros., Publishers, New York. 325 pp.

Daubenmire, R. F. 1952. Forest vegetation of northern Idaho and adjacent Washington and its bearing on concepts of vegetation classification. Ecol. Monog. 22: 301-330

Eckert, R. E. 1957. Vegetation-soil relationships in some *Artemisia* types in northern Harney and Lake Counties, Oregon. Ph. D. Thesis, Oreg. State Univ. 208 pp.

Goodall, D. W. 1952. Some considerations in the use of point quadrats for the analysis of vegetation. Australian Jour. of Sci. Research, Series B5: 1-41

Hanson, H. C. 1962. Dictionary of Ecology. Philosophical Library, New York, 382 pp.

Hunt, C. B. 1967. Physiography of the United States. W. H. Freeman and Company, San Francisco, 480 pp.

Hyder, D. N., C. E. Conrad, P. T. Tueller, L. D. Calvin, C. E. Poulton, and F. A. Sneva. 1963. Frequency sampling in sagebrush bunchgrass vegetation. Ecol. 44(4):740-746

Nevada Dept. of Conservation and Natural Resources and the U. S. Dept. of Agr., 1965. Water and related land resources: Humboldt River Basin, Nevada: Sonoma Sub-basin. Report No.10. 97 pp.

Poulton, C. E. 1962. Ecological reconnaissance of Oregon and adjacent areas. Oreg. State Univ. Mimeo. 16 pp.

_____ and E. W. Tisdale. 1961. A quantitative method for the description and classification of range vegetation. J. Range Manage. 14(1):13-21

Shockley, D. R. 1955. Capacity of soils to hold water. Agr. Eng. 36. pp. 109-112

Tschanz, C. M. and E. H. Pampeyan. 1961. Preliminary geologic map of Lincoln County, Nevada. U. S. Geological Survey.

Tueller, P. T. 1962. Plant succession of two *Artemisia* habitat-types in southeastern Oregon. Ph. D. Thesis, Corvallis, Ore. State Univ. 249 pp.

U. S. Dept. of Agr. 1951. Soil Survey Manual. USDA, Agr. Research Administration Handbook No. 18, 503 pp.

_____ 1954. Diagnosis and improvement of saline and alkali soils. USDA Handbook No. 60. 160 pp.

_____ 1960. A comprehensive system. The Seventh Approximation, Soil Survey Staff, Washington, D. C. USDA Soil. Cons. Service. 265 pp.

_____ 1967. Supplement to Soil Classification System (7th Approximation) Soil Survey Staff, Washington, D. C. USDA, Soil Cons. Service. 207 pp.

APPENDIX A.

Precipitation Data
for
Pine Canyon and Mathews Canyon Watersheds

Pine Canyon		Mathews Canyon	
Rain Can	Annual * Precipitation (Inches)	Rain Can	Annual* Precipitation (Inches)
1	14.1	1	16.3
2	16.1	2	20.4
3	18.0	3	20.7
4	14.4	4	17.2
5	15.9	5	17.4
6	17.2	6	17.1
7	16.3	7	16.3
8	16.1	8	15.1
9	14.9	9	14.7
10	16.5	Mean	17.2
11	17.7		
12	15.9		
Mean	16.1		

*Annual precipitation is based on four consecutive hydrologic years (October 1 to September 30), 1964-1967.

APPENDIX A (cont'd)

Community	Annual* Precipitation Inches
Artemisia nova/Bromus tectorum	17.1
Artemisia tridentata/Agropyron desertorum	15.1
A. tridentata/Chrysothamnus nauseosus	16.0
A. tridentata/Lupinus caudatus	17.0
Chrysothamnus nauseosus/A. tridentata	14.6
Juniperus osteosperma	15.4
J. osteosperma/A. nova	15.9
J. osteosperma/A. tridentata/Agropyron desertorum	15.1
J. osteosperma/A. tridentata/Bromus tectorum	17.7
J. osteosperma/A. tridentata/Bouteloua gracilis	14.9
J. osteosperma/A. tridentata/Hilaria jamesii	14.1
J. osteosperma/A. tridentata/Poa secunda	15.1
J. osteosperma/A. tridentata/Sitanion hystrix	15.8
J. osteosperma/Pinus monophylla	17.0
J. osteosperma/P. monophylla/Artemisia nova	17.2
J. osteosperma/P. monophylla/A. tridentata/Amelanchier pallida	15.8
J. osteosperma/P. monophylla/Chrysothamnus viscidiflorus/ Agropyron desertorum	16.8
J. osteosperma/P. monophylla/Quercus gambelii/ A. tridentata	16.3
Pinus monophylla/Amelanchier pallida/Arctostophylos patula	15.9
P. monophylla/A. pallida/Quercus gambelii	18.1
P. monophylla/J. osteosperma/A.nova/A. pallida	18.1
Pinus ponderosa/C. nauseosus/B. tectorum	16.6
P. ponderosa/Quercus gambelii	19.1
Prunus fasciculata/Quercus turbinella/B. tectorum	16.7
Quercus gambelii/Amelanchier pallida	18.4

*Annual precipitation is based on rain cans in or near each community and on 4 consecutive hydrologic years (October 1 to September 30), 1964-1967.

APPENDIX B. Soil Families and Subgroups as Associated with the Pine Canyon and Mathews Canyon Watershed Plant Communities.

APPENDIX B-1

Coarse-loamy, mixed, mesic family of Typic Xerofluvents

Typically these soils have a 2- to 10-inch ochric epipedon over a massive, loamy sand IICI horizon. Reaction of the surface horizon is neutral.

These soils are usually found at elevations from 5300 to 5900 feet and are associated with *Chrysothamnus nauseosus/Artemisia tridentata* and *Pinus ponderosa/Chrysothamnus nauseosus/Bromus tectorum* communities. They are usually found on north but may be on northwest facing drainage bottoms with 0 to 5 percent slope. Macrorelief is flat and microrelief is uniform flat. These soils belong to the B hydrologic group and have a profile available water holding capacity of 2.6 inches. Stoniness class is 0 to 2.

A 11	0-4"	Light brownish gray (10YR6/2) sandy loam, very dark grayish brown (10YR3/2) moist; moderate fine platy; soft, very friable, nonsticky, nonplastic; plentiful very fine and few fine roots; organic matter 0.7 percent, conductivity 0.15 mmhos., cation exchange capacity 10.0 meq.; noneffervescent; neutral (pH 6.9): vesicular pores; abrupt smooth boundary.
A 12	4-10"	Light brownish gray (10YR6/2) sandy loam, very dark grayish brown (10YR3/2) moist; weak coarse platy; soft, very friable, nonsticky, nonplastic; plentiful very fine, plentiful fine and few medium roots; noneffervescent; abrupt smooth boundary.
IICI	10-16"	Very dark grayish brown (10YR3/2) moist; loamy sand; massive; soft, very friable, nonsticky, nonplastic; Abundant fine and few coarse roots; noneffervescent; abrupt smooth boundary.
IIIC2	16-30"+	Dark brown (10YR3/3) moist; sand; massive; soft, very friable, nonsticky, nonplastic; noneffervescent.

APPENDIX B-2

Loamy-skeletal, mixed, mesic family of Typic Torriorthents

These soils characteristically have a 10-inch light brownish gray ochric epipedon over a massive, loamy sand C horizon. Reaction of the surface horizon is neutral.

They are usually found at elevations around 6000 feet and are associated with the *Juniperus osteosperma/Artemisia tridentata/Poa secunda* community. They are found on northwest facing slopes of 17 percent. The macrorelief is mountainous and the microrelief is convex. These soils belong to the B hydrologic group and have a profile available water holding capacity of 3.0 inches. Stoniness class is 3.

A 11	0-2"	Light brownish gray (10YR6/2) very gravelly loamy sand, very dark grayish brown (10YR3/2) moist; weak fine platy; soft, very friable, nonsticky, nonplastic; plentiful very fine roots; organic matter 2.8 percent, conductivity 0.6 mmhos, cation exchange capacity 11.9 meq.; noneffervescent; neutral (pH 7.6); abrupt smooth boundary, vesicular pores.
A 12	3-19"	Very dark grayish brown (10YR3/2) moist; very gravelly fine sandy loam; weak medium subangular blocky; soft, very friable, nonsticky, nonplastic; few very fine, plentiful fine, plentiful medium and few coarse roots; noneffervescent; clear smooth boundary.
C 1	19-35"+	Reddish brown (5YR4/3) moist; very gravelly loamy sand; massive; soft, very friable, nonsticky, nonplastic; few very fine, few fine and few medium roots; noneffervescent.

APPENDIX B-3

Loamy, mixed, mesic family of Lithic Torriorthents

Characteristically these soils have a 8-to 9-inch ochric epipedon over a massive, sandy loam C1 horizon. Reaction of the surface horizon is neutral.

These soils are usually found at elevations from 6025 to 6100 feet and are associated with the *Juniperus osteosperma/Artemisia nova* and *Juniperus osteosperma/Artemisia tridentata/Cowania stansburiana/ Bouteloua gracilis* communities. They are found on south or northeast facing ridges with 5 to 7 percent slope. Macrorelief is hilly and microrelief is convex. These soils belong to the D hydrologic group and have a profile available water holding capacity of 2.1 inches. Stoniness class is 4.

A 11	0-2"	Light brownish gray (10YR6/2) sandy loam, dark yellowish brown (10YR3/4) moist; moderate fine platy; soft, very friable, nonsticky, nonplastic; plentiful fine roots; organic matter 1.2 percent, conductivity 0.25 mmhos, cation exchange capacity 20.0 meq,; noneffervescent; neutral (pH 7.0); vesicular pores; abrupt smooth boundary.
A 12	2-9"	Dark brown (7.5YR3/2) moist; sandy clay loam; moderate medium subangular blocky; soft, very friable, sticky, slightly plastic; abundant very fine, abundant fine and few medium roots; non-effervescent; clear smooth boundary.
C 1	9-17"	Brown (7.5YR4/2) moist; sandy loam; massive; soft, very friable, sticky, nonplastic; abundant fine roots; noneffervescent; abrupt wavy boundary.
R 1	17"+	Bedrock.

APPENDIX B-4

Coarse-loamy, mixed, mesic family of Mollic Durorthids

Typically these soils have a 6-inch ochric epipedon over a moderate medium subangular blocky, silty loam B2 cambic horizon and an indurated duripan within 24 inches of the surface. Reaction of the solum is mildly alkaline.

These soils are usually found at elevations around 6000 feet and are associated with the *Juniperus osteosperma* community. They are found on northeast facing terraces of 3 percent. The macrorelief is undulating and the microrelief is convex. These soils belong to the D hydrologic group and have a profile available water holding capacity of 2.0 inches. Stoniness class is 2.

A 11	0-2"	Light brownish gray (10YR6/2) gravelly fine sandy loam, very dark grayish brown (10YR3/2) moist; weak medium platy; soft, very friable, slightly sticky, nonplastic; organic matter 1.7 percent, conductivity 0.3 mmhos, cation exchange capacity 15.2 meq.; slightly effervescent; mildly alkaline (pH 7.5); vesicular pores; abrupt smooth boundary.
A 12	2-6"	Dark brown (7.5YR3/2) moist; silt loam; weak medium subangular blocky; soft, very friable, slightly sticky, slightly plastic; plentiful very fine, abundant fine, and plentiful medium roots; strongly effervescent; abrupt smooth boundary.
B 2	6-12"	Brown (7.5YR5/3) moist; silt loam; moderate medium subangular blocky; slightly hard, very friable, slightly sticky, slightly plastic; plentiful fine, plentiful medium and plentiful coarse roots; violently effervescent; mildly alkaline (pH 7.8); abrupt smooth boundary.
C 1sica	12-24"	Weakly cemented duripan.
C 2sicam	24"+	Indurated duripan.

APPENDIX B-5

Fine-loamy, mixed, mesic family of Haplic Mollic Durargids

These soils characteristically have a 7-inch light brownish gray ochric epipedon over a subangular blocky, fine-loamy argillic horizon and a weakly cemented duripan within 24 inches of the surface. Reaction of the solum is neutral.

These soils are usually found at elevations around 5900 feet and are associated with the *Artemisia tridentata/Lupinus caudatus* community. They are found on west facing fans of 3 percent. The macrorelief is undulating and the microrelief is convex. These soils belong to the D hydrologic group and have a profile available water holding capacity of 5.4 inches. Stoniness class is 0.

A 11	0-2"	Light brownish gray (10YR6/2) fine sandy loam, dark brown (10YR3/3) moist; moderate medium platy; soft, very friable, nonsticky, nonplastic; plentiful very fine and abundant fine roots; organic matter 1.4 percent, conductivity 0.20 mmhos.,cation exchange capacity 6.2 meq.; noneffervescent; neutral (pH 6.6); vesicular pores; abrupt smooth boundary.
A 12	2-7"	Light brownish gray (10YR6/2) fine sandy loam, very dark grayish brown (10YR3/2) moist; weak coarse platy; soft, very friable, nonsticky, nonplastic; abundant very fine, abundant fine and plentiful medium roots; noneffervescent; abrupt smooth boundary.
B 1	7-12"	Light brownish gray (10YR6/2) gravelly loam, dark grayish brown (10YR4/2) moist; weak fine subangular blocky; soft, very friable, slightly sticky, slightly plastic; abundant fine and plentiful medium roots; noneffervescent; clear smooth boundary.
B 2^t	12-19"	Pale brown (10YR6/3) clay loam, brown (10YR4/3) moist; moderate medium subangular blocky; hard, friable, sticky, plastic; abundant very fine and abundant fine roots; organic matter 1.2 percent, conductivity 0.25 mmhos., noneffervescent; neutral (pH 7.2); abrupt smooth boundary.
C Isicam	19-24"	Light yellowish brown (10YR6/4) fine sandy loam, very dark grayish brown (10YR3/2) moist; massive; extremely hard, firm, nonsticky, nonplastic; violently effervescent; abrupt smooth boundary; weakly cemented duripan.
C 2	24-37"	Dark yellowish brown (10YR4/4) moist; very gravelly sandy loam; massive; soft, very friable, nonsticky, nonplastic; noneffervescent.

Fine, mixed, mesic family of Mollic Durargids

Characteristically these soils have a 1- to 6-inch ochric epipedon over a strong medium prismatic, clay argillic horizon and an indurated duripan within 13 to 37 inches of the surface. Reaction increases with depth and ranges from neutral to mildly alkaline.

These soils are usually found at elevations from 5100 to 6100 feet and are associated with the *Juniperus osteosperma*, *Juniperus osteosperma/Artemisia tridentata/Agropyron desertorum*, *Juniperus osteosperma/Artemisia tridentata/Hilaria jamesii*, *Juniperus osteosperma/Artmiisia tridentata/Poa secunda* and *Juniperus osteosperma/Artemisia tridentata/Sitanion hystrix* communities. They are found on north, northeast, east and south facing slopes or terraces of 2 to 12 percent. Macrorelief is hilly or rolling and microrelief is uniform convex. These soils belong to the D hydrologic group and have a profile available water holding capacity of 4.5 inches. Stoniness class is 0 to 4.

A 1	0-2"	Grayish brown (10YR5/2) gravelly fine sandy loam, very dark grayish brown (10YR3/2) moist; single grained; soft, very friable, nonsticky, nonplastic; organic matter 2.6 percent, conductivity 0.30 mmhos., cation exchange capacity 7.2 meq.; noneffervescent; neutral (pH 7.0); abrupt smooth boundary.
B 1	2-8"	Dark reddish brown (5YR3/2) moist; clay loam; weak coarse prismatic; slightly hard, friable, sticky, plastic; abundant very fine, abundant fine and plentiful medium roots; noneffervescent; clear smooth boundary.
B 2t	8-17"	Dark reddish brown (5YR3/4) moist; clay; strong medium prismatic; extremely hard, firm, very sticky, very plastic; plentiful fine and plentiful medium roots; organic matter 1.9 percent, conductivity 0.50 mmhos., noneffervescent; mildly alkaline (pH 7.4); pressure faces; clear smooth boundary.
B 3	17-27"	Reddish brown (5YR4/2) moist; clay; massive; extremely hard, firm, very sticky, very plastic; few fine roots; very slightly effervescent; abrupt smooth boundary.
C lsicam	27"+	Indurated duripan.

Fine, mixed, frigid family of Duric Mollic Haplargids

Typically these soils have a 2-inch ochric epipedon over a moderate medium prismatic, clay argillic horizon and durinodes within 27 inches of the surface. Reaction of the solum is slightly acid.

These soils are usually found at elevations around 6090 feet and are associated with the *Juniperus osteosperma/Pinus monophylla* community. They are found on east facing slopes of 7 percent. The macrorelief is mountainous and the microrelief is uniform convex. These soils belong to the D hydrologic group and have a profile available water holding capacity of 6.4 inches. Stoniness class is 4.

A 1	0-2"	Light brownish gray (10YR6/2) fine sandy loam, dark brown (7.5YR3/2) moist; strong fine platy; soft, very friable, nonsticky, nonplastic; plentiful very fine and plentiful fine roots; organic matter 2.3 percent, conductivity 0.15 mmhos., cation exchange capacity 23.4 meq.; noneffervescent; slightly acid (pH 6.2): vesicular pores; abrupt smooth boundary.
B 1	2-6"	Dark reddish brown (5YR3/3) moist; clay; weak coarse prismatic; slightly hard, very friable, very sticky, very plastic; noneffervescent; abrupt smooth boundary.
B 21t	6-12"	Dark reddish brown (5YR3/4) moist; clay; moderate medium prismatic; extremely hard, firm, very sticky, very plastic; organic matter 1.2 percent, conductivity 0.20 mmhos., noneffervescent; slightly acid (pH 6.5); pressure faces; clear smooth boundary.
B 22t	12-20"	Reddish brown (5YR4/4) moist; clay; moderate medium prismatic; extremely hard, firm, very sticky, very plastic; noneffervescent; clear smooth boundary.
B 3	20-27"	Yellowish red (5YR4/6) moist; clay loam; massive; hard, firm, sticky, plastic; noneffervescent; abrupt smooth boundary.
C 1	27-36"+	Very pale brown (10YR8/4) sandy clay, yellow (10YR7/6) moist; massive; extremely hard, firm, slightly sticky, slightly plastic; violently effervescent; durinodes.

Loamy-skeletal, mixed, frigid family of Lithic Mollic Haplargids

These soils characteristically have a 2-inch grayish brown ochric epipedon over a moderate fine subangular blocky, very gravelly clay loam argillic horizon and with lithic contact within 10 inches of the surface. Reaction of the solum is slightly acid.

These soils are usually found at elevations around 6000 feet and are associated with the *Quercus gambelli/Amelanchier pallida* community. They are found on north facing slopes of 22 percent. The macrorelief is mountainous and the microrelief is uniform convex. These soils belong to the D hydrologic group and have a profile available water holding capacity of 0.9 inch. Stoniness class is 4.

A 1	0-2"	Grayish brown (10YR5/2) very gravelly silt loam, dark brown (7.5YR3/2) moist; moderate medium platy; soft, very friable, slightly sticky, slightly plastic; abundant very fine and abundant fine roots; organic matter 2.9 percent, conductivity 0.20 mmhos., cation exchange capacity 14.9 meq.; noneffervescent; slightly acid (pH 6.5); vesicular pores; abrupt smooth boundary.
B 2t	2-10"	Light brown (7.5YR6/5) very gravelly clay loam, reddish brown (5YR4/3) moist; moderate fine subangular blocky; soft, very friable, sticky, plastic; abundant very fine, abundant fine, abundant medium, and plentiful coarse roots; noneffervescent; abrupt irregular boundary.
R 1	10"+	Bedrock.

Clayey-skeletal, mixed, frigid family of Lithic Mollic Haplargids

Typically these soils have a 5-inch ochric epipedon over a moderate fine subangular blocky, very gravelly clay argillic horizon and lithic contact within 16 inches of the surface. Reaction of the solum increases with depth and ranges from slightly acid to neutral.

These soils are found at elevations around 5950 feet and are associated with the *Pinus monophylla/Juniperus osteosperma/Artemisia nova/Amelanchier pallida* community. They are found on north facing slopes of 11 percent. The macrorelief is mountainous and the microrelief is uniform convex. These soils belong to the D hydrologic group and have a profile available water holding capacity of 1.7 inches. Stoniness class is 4.

A 1	0-2"	Very dark grayish brown (10YR3/2) gravelly fine sandy loam, very dark grayish brown (10YR3/2) moist; moderate fine platy; soft, very friable, nonsticky, nonplastic; plentiful very fine roots; organic matter 2.7 percent, conductivity 0.15 mmhos., cation exchange capacity 10.8 meq.; noneffervescent; slightly acid (pH 6.1); vesicular pores; abrupt smooth boundary.
A 3	2-5"	Very dark grayish brown (10YR3/2) gravelly clay loam; weak, medium platy; soft, very friable, slightly sticky, slightly plastic; plentiful very fine, abundant fine and plentiful medium roots; noneffervescent; abrupt smooth boundary.
B 21t	5-12"	Light brown (7.5YR6/4) moist; very gravelly clay; moderate fine subangular blocky; slightly hard, friable, very sticky, very plastic; plentiful very fine, abundant fine and abundant medium roots; 1.6 percent organic matter, conductivity 0.15 mmhos., cation exchange capacity 10.8 meq.; noneffervescent; neutral (pH 6.6); clear smooth boundary.
B 22t	12-16"	Reddish brown (5YR4/4) moist; very gravelly clay; massive; extremely hard, extremely firm, very sticky, very plastic; few fine roots; noneffervescent; abrupt irregular boundary.
R 1	16"+	Bedrock.

Fine, mixed, frigid, shallow family of Mollic Haplargids

These soils characteristically have a 7-to 9-inch light brownish gray ochric epipedon over a moderate fine subangular blocky, clay argillic horizon and paralithic contact within 20 inches of the surface. Reaction of the solum is slightly acid.

These soils are usually found at elevations from 5900 to 6250 feet and are associated with the *Pinus monophylla/Juniperus osteosperma/Artemisia nova/Amelanchier pallida* community. They are found on west or southeast facing slopes of 2 to 25 percent. The macrorelief is mountainous and the microrelief is uniform convex. These soils belong to the D hydrologic group and have a profile available water holding capacity of 3.7 inches. Stoniness class is 2 to 3.

A 11	0-3"	Light brownish gray (10YR6/2) loam, dark brown (7.5YR3/2) moist; medium moderate platy; soft, very friable, slightly sticky, slightly plastic; plentiful very fine and plentiful fine roots; organic matter 2.4 percent, conductivity 0.20 mmhos., cation exchange capacity 12.2 meq.; non-effervescent; slightly acid (pH 6.4); vesicular pores; abrupt smooth boundary.
A 12	3-7"	Light brownish gray (10YR6/2) clay loam, dark brown (7.5YR3/2) moist; medium fine granular; soft, very friable, sticky, plastic; abundant very fine, abundant fine and plentiful medium roots; noneffervescent; abrupt smooth boundary.
B2t	7-12"	Dark reddish brown (2.5YR3/4) moist; clay; moderate fine subangular blocky; slightly hard, friable, very sticky, very plastic; abundant very fine, abundant fine, plentiful medium and few coarse roots; organic matter 2.0 percent, conductivity 0.30 mmhos., noneffervescent; slightly acid (pH 6.4); clear smooth boundary.
B3	12-20"	Reddish brown (5.2YR4/4) moist; clay; massive; hard, firm, very sticky, very plastic; few fine and few medium roots; noneffervescent; clear irregular boundary.
R1	20"+	Weathered shale.

Loamy-skeletal, mixed, frigid family of Mollic Haplargids

Characteristically these soils have a 2-to 5-inch light brownish gray ochric epipedon over a moderate fine subangular blocky, very gravelly sandy clay loam argillic horizon. Reaction of the solum is neutral.

These soils are usually found at elevations from 6000 to 6200 feet and are associated with the *Juniperus osteosperma/Pinus monophylla* community. They are found on north facing slopes of 6 to 8 percent. Macrorelief is mountainous and the microrelief is uniform convex. These soils belong to the C hydrologic group and have a profile available water holding capacity of 1.9 inches. Stoniness class is 3.

A 1	0-2"	Light brownish gray (10YR6/2) gravelly fine sandy loam, very dark grayish brown (10YR3/2) moist; moderate medium platy; slighty hard, very friable, nonsticky, nonplastic; few fine roots; organic matter 3.4 percent, conductivity 0.25 mmhos., cation exchange capacity 7.2 meq.; noneffervescent; neutral (pH 6.7); vesicular pores; abrupt smooth boundary.
B2t	2-14"	Dark brown (10YR3/3) moist; very gravelly sandy clay loam; moderate fine subangular blocky; slightly hard, very friable, sticky, plastic, abundant very fine, abundant fine, abundant medium and few coarse roots; noneffervescent; clear smooth boundary.
C1	14-32"+	Brown (7.5YR4/2) moist; very gravelly sandy loam; massive; slightly hard, very friable, nonsticky, nonplastic, few fine, plentiful medium roots; noneffervescent.

Clayey-skeletal, mixed, mesic family of Mollic Haplargids

Typically these soils have a 5-inch light brownish gray ochric epipedon over a strong medium subangular blocky to massive, very gravelly clay argillic horizon. Reaction of the solum is neutral.

These soils are found at elevations around 5425 feet and are associated with the *Juniperus osteosperma/Artemisia nova* community. They are found on east facing terraces with 5 percent slopes. Macrorelief is rolling and microrelief is uniform convex. These soils belong to the D hydrologic group and have a profile available water holding capacity of 3.6 inches. Stoniness class is 3.

A 1	0-5"	Light brownish gray (10YR6/2) gravelly fine sandy loam, very dark brown (10YR2/2) moist; moderate medium platy; soft, very friable, nonsticky, nonplastic; abundant fine and few medium roots; organic matter 2.3 percent, conductivity 0.25 mmhos., cation exchange capacity 23.8 meq.; noneffervescent; neutral (pH 6.9); vesicular pores; abrupt smooth boundary.
B2t	5-16"	Dark reddish brown (5YR3/3) moist; very gravelly clay; strong medium subangular blocky; hard, firm, very sticky, very plastic; plentiful fine and abundant medium roots; organic matter 2.0 percent, conductivity 0.10 mmhos., noneffervescent; neutral (pH 7.0); clear smooth boundary.
B3	16-21"	Reddish brown (2.5YR4/4) moist; very gravelly clay; massive; hard, firm, very sticky, very plastic; few fine and plentiful medium roots; noneffervescent; clear smooth boundary.
C1	21-30"+	Red (2.5YR4/6) moist; very gravelly sandy clay loam; massive; slightly hard, friable, slightly sticky, slightly plastic; few medium roots; noneffervescent.

Fine, mixed, mesic family of Mollic Haplargids

These soils characteristically have a 2-to 10-inch light brownish gray ochric epipedon over a strong medium prismatic, clay argillic horizon. The soil associated with the *Artemisia nova/Bromus tectorum* community has lithic contact within 25 inches of the surface. Reaction of the solum is neutral.

These soils are usually found at elevations from 5400 to 6120 feet and are associated with the *Artemisia nova/Bromus tectorum, Artemisia tridentata/Agropyron desertorum, Juniperus osteosperma, Juniperus osteosperma/Artemisia tridentata/Agropyron desertorum, Juniperus osteosperma/Artemisia tridentata/Bromus tectorum, Juniperus osteosperma/Artemisia tridentata/Sitanion hystrix, Juniperus osteosperma/Pinus monophylla, Juniperus osteosperma/Pinus monophylla/Artemisia nova* and *Juniperus osteosperma/Pinus monophylla/Chrysothamnus viscidiflorus/Agropyron desertorum* communities. They are found on all aspects with 2 to 12 percent slopes and terraces. The macrorelief is undulating, hilly or mountainous and the microrelief is uniform convex. These soils belong to the D hydrologic group and have a profile available water holding capacity that ranges from 3.8 to 7.1 inches. Stoniness class is 0 to 3.

A 11	0-2"	Light brownish gray (10YR6/2) fine sandy loam, dark brown (7.5YR3/2) moist; weak medium platy; soft, very friable, nonsticky, nonplastic; abundant fine roots; organic matter 2.9 percent, conductivity 0.30 mmhos., cation exchange capacity 21.2 meq.; noneffervescent; neutral (pH 6.9); vesicular pores; abrupt smooth boundary.
A 12	2-7"	Dark brown (7.5YR3/2) moist; clay loam; weak, fine subangular blocky; soft, very friable, sticky, plastic; abundant very fine and abundant fine roots; noneffervescent; abrupt smooth boundary.
B 1	7-11"	Dark reddish brown (5YR3/2) moist; clay loam; moderate fine subangular blocky; slightly hard, very friable, very sticky, very plastic; abundant very fine and abundant fine roots; noneffervescent; abrupt smooth boundary.
B2t	11-27"	Dark reddish brown (5YR3/2) moist; clay; moderate medium prismatic; extremely hard, firm, very sticky, very plastic; plentiful very fine and plentiful fine roots; noneffervescent; clear smooth boundary.

B2t	27-34"	Dark reddish brown (5YR3/4) moist; clay; strong medium prismatic; extremely hard, firm, very sticky, very plastic; few fine roots; organic matter 1.3 percent, conductivity 0.20 mmhos., noneffervescent; neutral (pH 7.0); gradual smooth boundary.
B3	34-39"+	Yellowish red (5YR4/6) moist; clay; massive; hard, firm, very sticky, very plastic; noneffervescent.

APPENDIX B-14

Fine, mixed, frigid family of Mollic Haplargids

Characteristically these soils have a 6-to 14-inch light brownish gray ochric epipedon over a moderate medium subangular blocky, clay argillic horizon. The soil associated with the *Pinus monophylla/Juniperus osteosperma/Artemisia nova/Amelanchier pallida* community has lithic contact within 33 inches of the surface. Reaction of the solum is slightly acid.

These soils are usually found at elevations from 6075 to 6750 feet and are associated with the *Juniperus osteosperma/Pinus monophylla, Juniperus osteosperma/Pinus monophylla/Quercus gambelii/Artemisia tridentata, Pinus monophylla/Amelanchier pallida/Quercus gambelii* and *Pinus monophylla/Juniperus osteosperma/Artemisia nova/Amelanchier pallida* communities. They are found on northeast, northwest, west and southwest facing slopes of 4 to 45 percent. The macrorelief is undulating, rolling, or mountainous and the microrelief is uniform convex. These soils belong to the D hydrologic group and have a profile available water holding capacity of 7.2 inches. Stoniness class is 2 to 4.

A 11	0-2"	Light brownish gray(10YR6/2) fine sandy loam, very dark grayish brown (10YR3/2) moist; weak fine platy; soft, very friable, nonsticky, nonplastic; few fine roots; organic matter 2.0 percent, conductivity 0.25 mmhos., cation exchange capacity 16.2 meq.; non-effervescent; slightly acid (pH 6.3); vesicular pores; abrupt smooth boundary.
A 12	2-11"	Very dark grayish brown (10YR3/2) moist; silt loam; weak medium prismatic; soft, very friable, slightly sticky, slightly plastic; abundant very fine, abundant fine, plentiful medium roots; noneffervescent; abrupt smooth boundary.

B2t	11-17"	Very dark brown (10YR2/2) moist;clay; moderate medium prismatic; slightly hard, friable, very sticky, very plastic; abundant fine, plentiful medium and few coarse roots; noneffervescent; clear smooth boundary.
B3	17-39"	Reddish brown (5YR5/4) moist; clay; moderate fine subangular blocky; hard, friable, very sticky, very plastic; few fine roots; non-effervescent; clear smooth boundary.
C1	29-39"+	Yellowish red (5YR4/8) moist; clay; massive; extremely hard, firm, very sticky, very plastic; noneffervescent.

APPENDIX B-15

Loamy-skeletal, mixed, frigid family of Typic Argixerolls

These soils characteristically have a 10-inch mollic epipedon over a moderate medium subangular blocky, gravelly clay loam argillic horizon. Reaction of the solum decreases with depth and ranges from neutral to slightly acid.

These soils are usually found at elevations around 6125 feet and are associated with the *Prunus fasciculata/Quercus turbinella/Bromus tectorum* community. They are found on southwest facing slopes of 25 percent. The macrorelief is mountainous and the microrelief is uniform convex. These soils belong to the C hydrologic group and have a profile available water holding capacity of 4.7 inches. Stoniness class is 4.

A 1	0-10"	Grayish brown (10YR5/2) gravelly silt loam, very dark grayish brown (10YR3/2) moist; weak medium subangular blocky; soft, very friable, slightly sticky, slightly plastic; abundant fine roots; organic matter 2.0 percent, conductivity 0.35 mmhos., cation exchange capacity 9.5 meq.; noneffervescent; neutral (pH 7.3); abrupt smooth boundary.
B 2t	10-21"	Reddish brown (5YR5/3) moist; gravelly clay loam; moderate medium subangular blocky; slightly hard, friable, sticky, plastic; abundant fine and few medium roots: organic matter 1.2 percent, conductivity 0.25 mmhos.; noneffervescent; slightly acid (pH 6.3): clear smooth boundary.

B 3	21-29"	Light reddish brown (5YR6/4) moist; gravelly clay loam; massive; slightly hard, friable, very sticky, very plastic; few fine and plentiful coarse roots; noneffervescent; clear smooth boundary.
C1	29-38"+	Light brownish gray (10YR6/2) moist; fine sandy loam; massive; soft, very friable, nonsticky, nonplastic; few coarse roots; noneffervescent.

APPENDIX B-16

Fine-loamy, mixed, frigid family of Pachic Argixerolls

Typically these soils have a 20-inch mollic epipedon over a moderate fine subangular blocky, sandy clay loam argillic horizon. Reaction of the solum is neutral.

These soils are usually found at elevations around 6300 feet and are associated with the *Artemisia tridentata/Chrysothamnus nauseosus* community. They are found on north facing slopes of 2 percent. The macrorelief is undulating and the microrelief is uniform concave. These soils belong to the C hydrologic group and have a profile available water holding capacity of 6.5 inches. Stoniness class is 0.

A 11	0-3"	Dark grayish brown (10YR4/2) silt loam, very dark brown (10YR2/2) moist; strong very fine platy; slightly hard, very friable, slightly sticky, slightly plastic; abundant very fine and plentiful fine roots; organic matter 2.6 percent, conductivity 0.10 mmhos., cation exchange capacity 12.5 meq.; noneffervescent; neutral (pH 6.6); vesicular pores; abrupt smooth boundary.
A 12	3-11"	Very dark brown (10YR2/2) moist; silt loam; weak coarse platy; soft, very friable, slightly sticky, slightly plastic; abundant very fine, abundant fine, plentiful medium and plentiful coarse roots; noneffervescent; abrupt smooth boundary.
B2t	11-20"	Very dark brown (10YR2/2) moist; sandy clay; moderate fine subangular blocky; slightly hard, friable, sticky, plastic; organic matter 2.4 percent, conductivity 0.15 mmhos., noneffervescent; neutral (pH 6.6); clear smooth boundary.

B3	20-32"	Very dark grayish brown (10YR3/2) moist; sandy clay loam; massive; slightly hard, very friable, slightly sticky, slightly plastic; abundant fine roots; noneffervescent; clear smooth boundary.
C1	32-40"+	Very dark grayish brown (10YR3/2) moist; fine sandy loam; massive; soft, very friable, non-sticky, nonplastic; abundant fine and few medium roots; noneffervescent.

APPENDIX B-17

Fine, mixed, mesic family of Typic Argixerolls

These soils characteristically have an 11-inch mollic epipedon over a strong fine subangular blocky to massive, clay argillic horizon. Reaction of the solum is neutral.

These soils are usually found at elevations around 5600 feet and are associated with the *Juniperus osteosperma/Artemisia tridentata/Sitanion hystrix* community. They are found on north facing slopes of 2 percent. The macrorelief is flat and the microrelief is uniform flat. These soils belong to the D hydrologic group and have a profile available water holding capacity of 6.3 inches. Stoniness class is 2.

A 1	0-2"	Brown (10YR5/3) clay loam, dark brown (7.5YR3/2) moist; moderate medium platy; soft, very friable, sticky, plastic; few very fine roots; organic matter 1.9 percent, conductivity 0.20 mmhos., cation exchange capacity 13.2 meq.; noneffervescent; neutral (pH 6.7); vesicular pores; abrupt smooth boundary.
A 3	2-7"	Dark reddish brown (5YR3/2) moist; clay; weak medium prismatic; slightly hard, friable, very sticky, very plastic; abundant very fine, abundant fine, and few medium roots; noneffervescent; abrupt smooth boundary.
B 1	7-11"	Dark reddish brown (5YR3/3) moist; clay; weak medium prismatic; slightly hard, friable, very sticky, very plastic; plentiful very fine, plentiful fine and few medium roots; noneffervescent; abrupt smooth boundary.
B2t	11-18"	Dark red (2.5YR3/6) moist; clay; strong fine subangular blocky to massive; extremely hard, extremely firm; very sticky, very plastic; few fine and few medium roots; organic matter 1.3 percent, conductivity 0.15 mmhos., noneffervescent; neutral (pH 6.8); clear smooth boundary.

B3	18-30"	Red (2.5YR4/6) moist; gravelly clay; massive; hard, firm, very sticky, very plastic; few fine and few medium roots; noneffervescent; gradual smooth boundary.
C 1	30-40"+	Red (2.5YR5/8) moist; very gravelly clay; massive; hard, friable, very sticky, very plastic; non-effervescent.

APPENDIX B-18

Fine, mixed, frigid family of Typic Argixerolls

Characteristically these soils have a 7-inch mollic epipedon over a moderate strong medium prismatic, clay argillic horizon. Reaction of the solum increases with depth and ranges from slightly acid to neutral.

These soils are usually found at elevations around 6100 feet and are associated with the *Pinus ponderosa/Quercus gambelii* community. They are found on north facing slopes of 11 percent. The macrorelief is mountainous and the microrelief is uniform convex. These soils belong to the D hydrologic group and have a profile available water holding capacity of 5.6 inches. Stoniness class is 4.

A 11	0-2"	Grayish brown (10YR5/2) sandy loam, very dark brown (10YR2/2) moist; strong fine platy; soft, very friable, nonsticky, nonplastic; abundant fine roots; organic matter 1.8 percent, conductivity 0.30 mmhos., cation exchange capacity 15.8 meq.; noneffervescent; slightly acid (pH 6.4); vesicular pores; abrupt smooth boundary.
A 12	2-7"	Grayish brown (10YR5/2) sandy clay loam, very dark brown (10YR2/2) moist; moderate medium subangular blocky; soft, friable, slightly sticky, slightly plastic; abundant very fine, abundant fine and plentiful medium roots; noneffervescent; abrupt smooth boundary.
B21t	7-13"	Dark reddish brown (5YR3/4) moist; clay; moderate medium prismatic; slightly hard, friable, very sticky, very plastic; abundant very fine, abundant fine, abundant medium and few coarse roots; organic matter 0.2 percent, conductivity 0.40 mmhos., non-effervescent; neutral (pH 6.6); clear smooth boundary.

B22t	13-20"	Red (2.5YR4/6) moist; clay; strong medium prismatic; hard, firm, very sticky, very plastic; abundant very fine, abundant fine, plentiful medium and plentiful coarse roots; noneffervescent; gradual smooth boundary.
B3	20-32"+	Red (10YR4/6) and mottles of white (2.5YR8/1) moist; clay; massive; hard, firm, very sticky, very plastic; noneffervescent.

APPENDIX B-19

Fine, mixed, mesic family of Duric Argixerolls

Typically these soils have a 9-to 18-inch mollic epipedon over a moderate to strong medium prismatic, clay argillic horizon, and an indurated duripan within 23 inches of the surface. Reaction of the solum is neutral.

These soils are usually found at elevations from 5650 to 6040 feet and are associated with the *Juniperus osteosperma/Artemisia tridentata/Agropyron desertorum* and *Juniperus osteosperma/Artemisia tridentata/Sitanion hystrix* communities. They are found on south or east facing slopes of 1 to 20 percent. The macrorelief is flat or mountainous and the microrelief is uniform flat or uniform convex. These soils belong to the D hydrologic group and have a profile available water holding capacity of 4.4 inches. Stoniness class is 1 to 3.

A 1	0-2"	Dark reddish brown (5YR3/2) moist; clay loam; weak medium platy; soft, very friable, sticky, plastic; abundant fine roots; organic matter 2.0 percent, conductivity 0.30 mmhos., cation exchange capacity 11.5 meq.; noneffervescent; neutral (pH 7.0); vesicular pores; abrupt smooth boundary.
A 3	2-9"	Dark reddish brown (5YR3/2) moist; clay; weak medium prismatic; slightly hard, friable, very sticky, very plastic; abundant very fine, abundant fine, and plentiful medium roots; noneffervescent; abrupt smooth boundary.
B21t	9-17"	Reddish brown (5YR4/3) moist; clay; moderate medium prismatic; hard, firm, very sticky, very plastic; abundant fine, abundant medium roots; organic matter 2.8 percent, conductivity 0.20 mmhos., noneffervescent; neutral (pH 6.7); pressure faces; clear smooth boundary.

B22t	17-23"	Yellowish red (5YR4/6) moist; clay; massive; extremely hard, firm, very sticky, very plastic; plentiful fine and plentiful medium roots; violently effervescent; abrupt smooth boundary.
Clcasim	23"+	Indurated duripan.

APPENDIX B-20

Fine, mixed, frigid, shallow family of Typic Argixerolls

Typically these soils have a 19-inch mollic epipedon over a strong fine subangular blocky to massive, gravelly clay argillic horizon and paralithic contact within 19 inches of the surface. Reaction increases with depth and ranges from slightly acid to neutral.

These soils are usually found at elevations around 5700 feet and are associated with the *Juniperus osteosperma/Pinus monophylla/Artemisia tridentata/Amelanchier pallida* community. They are found on west facing slopes of 6 percent. Macrorelief is mountainous and microrelief is uniform convex. These soils belong to the D hydrologic group and have a profile available water holding capacity of 2.9 inches. Stoniness class is 3.

A1	0-2"	Very dark brown (10YR2/2) moist; gravelly silt loam, moderate medium platy; soft, very friable, slightly sticky, slightly plastic; few fine roots; organic matter 3.8 percent, conductivity 0.25 mmhos., cation exchange capacity 17.0 meq.; noneffervescent; slightly acid (pH 6.4); vesicular pores; abrupt smooth boundary.
A3	2-10"	Very dark brown (10YR2/2) moist; gravelly clay loam; weak medium subangular blocky; soft, very friable, sticky, plastic; abundant very fine, abundant fine and plentiful medium roots; noneffervescent; abrupt smooth boundary.
B2t	10-16"	Very dark grayish brown (10YR3/2) moist; gravelly clay; strong fine subangular blocky; hard, firm, very sticky, very plastic; few very fine, plentiful fine and plentiful medium roots; organic matter 1.6 percent, conductivity 0.10 mmhos., noneffervescent; neutral (pH 6.6); clear smooth boundary.
B3	16-19"	Dark reddish brown (5YR3/3) moist; gravelly clay; massive; hard, firm, very sticky, very plastic; few fine roots; noneffervescent; abrupt wavy boundary.
R1	19"+	Weather bedrock.

Fine, mixed, mesic family of Pachic Argixerolls

These soils characteristically have a 27-inch mollic epipedon over a moderate medium prismatic to massive, gravelly clay argillic horizon. Reaction of the solum is neutral.

These soils are usually found at elevations around 5650 feet and are associated with the *Juniperus osteosperma* community. They are found on north facing slopes of 3 percent. The macrorelief is undulating and the microrelief is uniform concave. These soils belong to the D hydrologic group and have a profile available water holding capacity of 5.7 inches. Stoniness class is 2.

A 1	0-2"	Brown (10YR5/3) fine sandy loam, very dark grayish brown (10YR3/2) moist; moderate medium platy; soft, very friable, nonsticky, nonplastic; plentiful fine roots; organic matter 4.6 percent, conductivity 0.50 mmhos., cation exchange capacity 18.5 meq.; noneffervescent; neutral (pH 6.6); vesicular pores; abrupt smooth boundary.
A 3	2-10"	Dark reddish brown (5YR2/2) moist; gravelly clay loam, weak fine subangular blocky; soft, very friable, sticky, plastic; abundant very fine, abundant fine, abundant medium and few coarse roots; noneffervescent; abrupt smooth boundary.
B2t	10-19"	Dark reddish brown (5YR3/2) moist; gravelly clay; moderate medium prismatic; hard, firm, very sticky, very plastic; plentiful fine and few medium roots; organic matter 2.3 percent, conductivity 0.20 mmhos., noneffervescent; neutral (pH 6.7); clear smooth boundary.
B3	19-27"	Dark brown (7.5YR3/2) moist; gravelly clay; massive; extremely hard, extremely firm, very sticky, very plastic; few fine roots; noneffervescent; gradual smooth boundary.
C1	27-40"+	Reddish brown (5YR4/4) moist; clay; massive; hard, firm, very sticky very plastic; noneffervescent.

Fine, mixed, frigid family of Pachic Argixerolls

Typically these soils have a 33-inch mollic epipedon over a strong fine subangular blocky to massive, clay argillic horizon. Reaction of the solum is slightly acid.

These soils are usually found at elevations around 6100 feet and are associated with the *Juniperus osteosperma/Pinus monophylla/Quercus gambelii/Artemisia tridentata* community. They are found on northeast facing slopes of 38 percent. The macrorelief is mountainous and the microrelief is uniform convex. These soils belong to the D hydrologic group and have a profile available water holding capacity of 7.1 inches. Stoniness class is 4.

A 1	0-7"	Dark reddish brown (5YR2/2) moist; gravelly light clay; weak fine subangular blocky; soft, very friable, very sticky, very plastic; abundant very fine and abundant fine roots; organic matter 3.4 percent, conductivity 0.35 mmhos., cation exchange capacity 29.5 meq.; noneffervescent; slightly acid (pH 6.3); abrupt smooth boundary.
B21t	7-17"	Dark reddish brown (5YR3/2) moist; gravelly clay; strong fine subangular blocky; hard, friable, very sticky, very plastic; abundant fine and plentiful medium roots; organic matter 1.9 percent, conductivity 0.25 mmhos., noneffervescent; slightly acid (pH 6.4); abrupt smooth boundary.
B22t	17-23"	Dark brown (7.5YR3/2) moist; clay; massive; hard, firm, very sticky, very plastic; few fine roots; noneffervescent; clear smooth boundary.
B3	23-33"	Dark brown (7.5YR3/2) moist; clay; massive; hard, firm, very sticky, very plastic; noneffervescent; clear smooth boundary.
C1	33-40"+	Dark reddish brown (5YR3/4) moist; clay; massive; extremely hard, firm, very sticky, very plastic; noneffervescent.

Coarse-loamy, mixed, mesic family of Typic Haploxerolls

Typically these soils have a 10-to 16-inch mollic epipedon over a weak coarse prismatic, silt loam cambic horizon. Reaction of the solum is neutral.

These soils are usually found at elevations around 5300 to 6320 feet and are associated with the *Artemisia tridentata/Chrysothamnus nauseosus* and *Chrysothamnus nauseosus/Artemisia tridentata* communities. They are found on northwest facing slopes and drainage bottoms of 1 to 2 percent. The macrorelief is undulating and the microrelief is uniform convex. These soils belong to the B hydrologic group and have a profile available water holding capacity of 4.9 inches. Stoniness class is 0.

A 11	0-2"	Grayish brown (10YR5/2) silt loam, very dark grayish brown (10YR3/2) moist; moderate fine platy; soft, very friable, slightly sticky, slightly plastic; organic matter 2.1 percent, conductivity 0.40 mmhos., cation exchange capacity 18.0 meq.; noneffervescent; neutral (pH 7.2); vesicular pores; abrupt smooth boundary.
A 12	2-10"	Dark reddish brown (5YR3/2) moist; silt loam; moderate medium platy; soft, very friable, slightly sticky, slightly plastic; plentiful fine and abundant medium roots; noneffervescent; clear smooth boundary.
B2*	10-22"	Dark reddish brown (5YR3/2) moist; silt loam; weak coarse prismatic; soft, very friable, slightly sticky, slightly plastic; few fine and plentiful medium roots; noneffervescent; clear smooth boundary.
C1	22-39"+	Dark reddish brown (5YR3/2) moist; loamy sand; massive; soft, very friable, nonsticky, nonplastic; strongly effervescent; plentiful medium roots.

* Soil Laboratory Data Missing

Coarse-loamy, mixed, frigid family of Entic Haploxerolls

These soils characteristically have an 8-to 12-inch mollic epipedon over a massive, weak red sandy loam C1 horizon. Reaction of the solum is neutral.

These soils are usually found at elevations from 5700 to 6750 feet and are associated with the *Quercus gambelii/Amelanchier pallida*, *Pinus monophylla/Amelanchier pallida/Quercus gambelii* and *Pinus ponderosus/Quercus gambelii* communities. They are found on north, east and west facing slopes of 11 to 59 percent. The macrorelief is mountainous and the microrelief is uniform convex or uniform concave. These soils belong to the B hydrologic group and have a profile available water holding capacity of 1.6 inches. Stoniness class is 4.

A 11	0-8"	Very dark grayish brown (10YR3/2) sandy loam, dark reddish brown (5YR2/2) moist; moderate medium subangular blocky; soft, very friable, nonsticky, nonplastic; abundant very fine, abundant fine, few medium and few coarse roots; organic matter 2.4 percent, conductivity 0.40 mmhos., cation exchange capacity 16.8 meq.; noneffervescent; neutral (pH 6.9); abrupt clear boundary.
A 12	8-14"	Pinkish gray (5YR6/2) sandy loam, dark reddish gray (5YR4/2) moist; moderate coarse subangular blocky; slightly hard, friable, nonsticky, nonplastic; plentiful very fine, abundant fine, plentiful medium and few coarse roots; noneffervescent; clear smooth boundary.
C1	14-19"	Weak red (2.5YR4/2) moist; sandy loam; massive; hard, friable, nonsticky, nonplastic; plentiful fine and plentiful medium roots; noneffervescent; clear smooth boundary.
C2	19-30"+	Weak red (2.5YR4/2) moist; sandy loam; massive; hard, friable, nonsticky, nonplastic; few fine and few coarse roots; noneffervescent.

Fine-loamy, mixed, frigid, shallow family of Entic Haploxerolls

Typically these soils have a 7-inch mollic epipedon over weathered shale that is within 8 inches of the surface. Reaction of the surface horizon is medium acid.

These soils are usually found at elevations around 5750 feet and are associated with the *Pinus monophylla/Amelanchier pallida/Arctostophylos patula* community. They are found on northwest facing slopes of 11 percent. The macrorelief is mountainous and the microrelief is uniform convex. These soils belong to the D hydrologic group and have a profile available water holding capacity of 1.0 inch. Stoniness class is 2.

A 11	0-2"	Very dark grayish brown (10YR3/2) moist; gravelly fine sandy loam; weak medium platy; soft, very friable, nonsticky, nonplastic; plentiful fine roots; organic matter 3.1 percent, conductivity 0.20 mmhos., noneffervescent; medium acid (pH 5.7); vesicular pores; abrupt smooth boundary.
A 12	2-8"	Grayish brown (10YR5/2) sandy clay loam, dark brown (10YR3/3) moist; moderate medium granular; soft, very friable, slightly sticky, slightly plastic; plentiful very fine, plentiful fine, and plentiful medium roots; noneffervescent; abrupt smooth boundary.
R 1	8-14"	Loose shale.
R 2	14"+	Shale bedrock.

Fine, mixed, frigid family of Lithic Haploxerolls

Characteristically these soils have a 12-inch mollic epipedon over lithic contact. Reaction of the surface horizon is slightly acid.

These soils are usually found at elevations around 6600 feet and are associated with the *Pinus monophylla/Juniperus osteosperma/Artemisia nova/Amelanchier pallida* community. They are found on northeast facing slopes of 7 percent. The macrorelief is mountainous and the microrelief is uniform convex. These soils belong to the D hydrologic group and have a profile available water holding capacity of 2.3 inches. Stoniness class is 3.

A 11	0-8"	Grayish brown (10YR5/2) sandy clay, very dark brown (10YR2/2) moist; moderate medium subangular blocky; soft, very friable, very sticky, very plastic; abundant fine, abundant medium, and few coarse roots; organic matter 4.3 percent, conductivity 0.10 mmhos., cation exchange capacity 22.1 meq.; non-effervescent; slightly acid (pH 6.5); clear smooth boundary.
A 12	8-12"	Dark brown (7.5YR3/2) moist; sandy clay; massive; slightly hard, friable, very sticky, very plastic; plentiful fine and plentiful medium roots; non-effervescent; abrupt wavy boundary.
R1	12"+	Bedrock.

APPENDIX C VEGETATION AND SOILS ASSOCIATION TABLE FOR PINE CANYON AND MATHEWS CANYON WATERSHEDS

COMMUNITIES \ SOILS	Xerofluvents	Torriorthents		Durorthids	Durargids		Haplargids								Argixerolls								Haploxerolls			
	Coarse-loamy, mixed, mesic family of Typic Xerofluvents	Loamy-skeletal, mixed, mesic family of Typic Torriorthents	Loamy, mixed mesic family of Lithic Torriorthents	Coarse-loamy, mixed, mesic family of Mollic Durorthids	Fine-loamy, mixed, mesic family of Haplic Mollic Durargids	Fine, mixed, mesic family of Mollic Durargids	Fine, mixed, frigid family of Duric Mollic Haplargids	Loamy-skeletal, mixed, frigid family of Lithic Mollic Haplargids	Clayey-skeletal, mixed, frigid family of Lithic Mollic Haplargids	Fine, mixed, frigid, shallow family of Mollic Haplargids	Loamy-skeletal, mixed, frigid family of Mollic Haplargids	Clayey-skeletal, mixed, mesic family of Mollic Haplargids	Fine, mixed, mesic family of Mollic Haplargids	Fine, mixed, frigid family of Mollic Haplargids	Loamy-skeletal, mixed, frigid family of Typic Argixerolls	Fine-loamy, mixed, frigid family of Pachic Argixerolls	Fine, mixed, mesic family of Typic Argixerolls	Fine, mixed, frigid family of Typic Argixerolls	Fine, mixed, mesic family of Duric Argixerolls	Fine, mixed, frigid, shallow family of Typic Argixerolls	Fine, mixed, mesic family of Pachic Argixerolls	Fine, mixed, frigid family of Pachic Argixerolls	Coarse-loamy, mixed, mesic family of Typic Haploxerolls	Coarse-loamy, mixed frigid family of Entic Haploxerolls	Fine-loamy, mixed, frigid, shallow family of Entic Haploxerolls	Fine, mixed, frigid family of Lithic Haploxerolls
Artemisia nova/ Bromus tectorum													X													
Artemisia tridentata/ Agropyron desertorum													X													
Artemisia tridentata/ Chrysothamnus nauseosus																X							X			
Artemisia tridentata/ Lupinus caudatus					X																					
Chrysothamnus nauseosus/ Artemisia tridentata	X																						X			
Juniperus osteosperma				X		X							X									X				
Juniperus osteosperma/ Artemisia nova			X									X														
J. osteosperma/A. tridentata/ Agropyron desertorum						X							X													
J. osteosperma/A. tridentata/ Bromus tectorum													X													
J. osteosperma/A. tridentata/ Cowania stansburiana/ Bouteloua gracilis			X																							
J. osteosperma/A. tridentata/ Hilaria jamesii						X																				
J. osteosperma/A. tridentata/ Poa secunda		X				X																				
J. osteosperma/A. tridentata/ Sitanion hystrix						X							X				X		X							
J. osteosperma/ Pinus monophylla							X				X		X	X												
J. osteosperma/P. monophylla/ Artemisia nova													X													
J. osteosperma/P. monophylla/ A. tridentata/Amelanchier pallida								X												X						
J. osteosperma/P. monophylla/ Chrystohamnus viscidiflorus/ Agropyron desertorum													X													
J. osteosperma/P. monophylla/ Quercus gambelii/ Artemisia tridentata														X								X				
P. monophylla/Amelanchier pallida/ Arctostophylos patula																								X		
P. monophylla/Amelanchier pallida/ Quercus gambelii														X									X			
P. monophylla/J. osteosperma/ A. nova/Amelanchier pallida									X					X												X
Pinus ponderosa/C. nauseosus/ Bromus tectorum	X																									
Pinus ponderosa/ Quercus gambelli																		X					X			
Prunus fasciculata/Quercus turbinella/Bromus tectorum															X											
Quercus gambelii/ Amelanchier pallida								X															X			

PINE CANYON AND MATHEWS CANYON WATERSHEDS

VEGETATION MAPPING UNITS AND PRECIPITATION, STREAM FLOW RECORDING STATIONS

SCALE 1:31680

1 .5 0 1 2 Miles

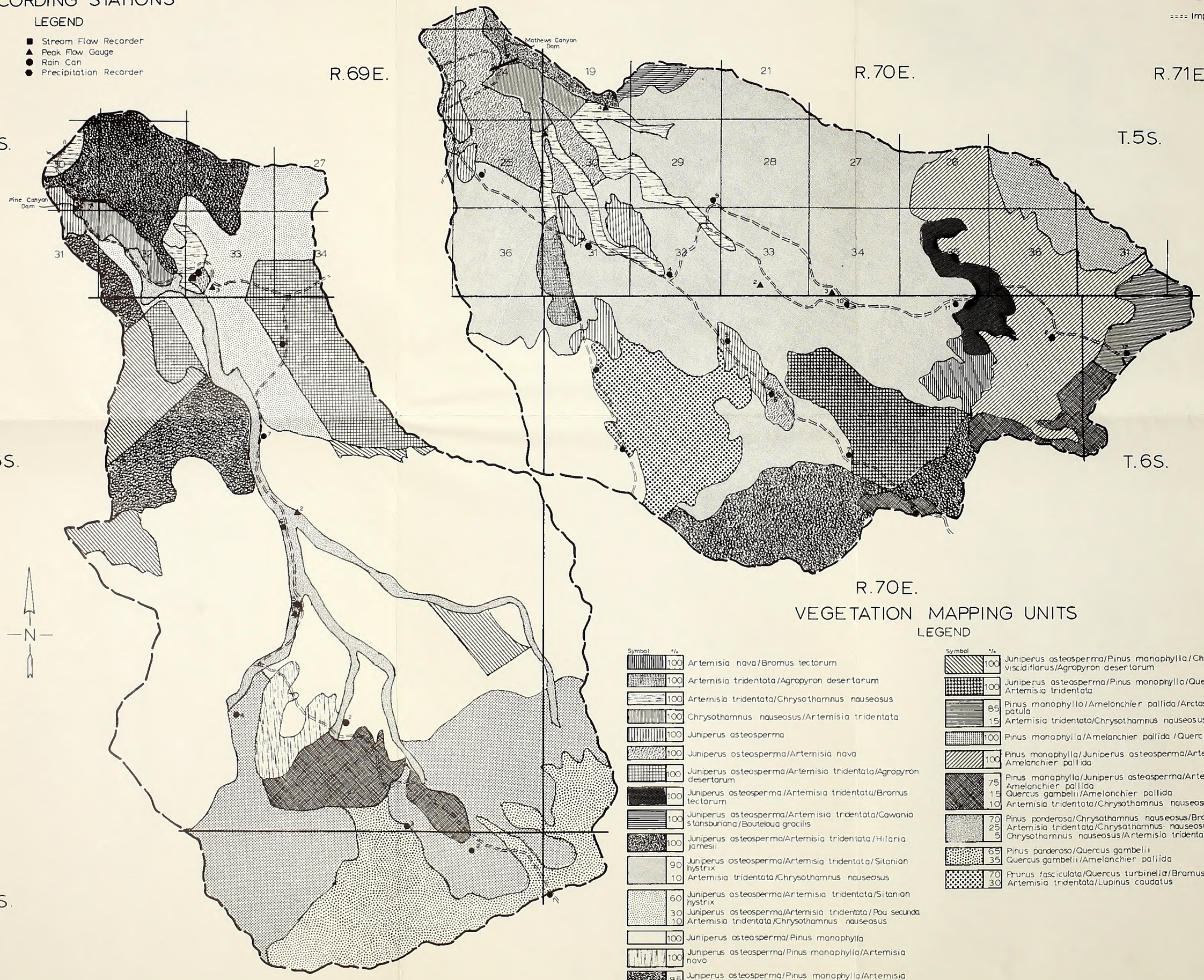
PRECIPITATION AND STREAM FLOW RECORDING STATIONS

LEGEND

- ■ Stream Flow Recorder
- ▲ Peak Flow Gauge
- ● Rain Can
- ⬢ Precipitation Recorder

ROAD LEGEND

==== Improved Dirt



VEGETATION MAPPING UNITS

LEGEND

Symbol	%	
	100	Artemisia nova/Bromus tectorum
	100	Artemisia tridentata/Agropyron desertarum
	100	Artemisia tridentata/Chrysothamnus nauseosus
	100	Chrysothamnus nauseosus/Artemisia tridentata
	100	Juniperus osteosperma
	100	Juniperus osteosperma/Artemisia nova
	100	Juniperus osteosperma/Artemisia tridentata/Agropyron desertarum
	100	Juniperus osteosperma/Artemisia tridentata/Bromus tectorum
	100	Juniperus osteosperma/Artemisia tridentata/Cowania stansburiana/Bouteloua gracilis
	100	Juniperus osteosperma/Artemisia tridentata/Hilaria jamesii
	90	Juniperus osteosperma/Artemisia tridentata/Sitanion hystrix
	10	Artemisia tridentata/Chrysothamnus nauseosus
	60	Juniperus osteosperma/Artemisia tridentata/Sitanion hystrix
	30	Juniperus osteosperma/Artemisia tridentata/Poa secunda
	10	Artemisia tridentata/Chrysothamnus nauseosus
	100	Juniperus osteosperma/Pinus monophylla
	100	Juniperus osteosperma/Pinus monophylla/Artemisia nova
	85	Juniperus osteosperma/Pinus monophylla/Artemisia tridentata/Amelanchier pallida
	15	Artemisia tridentata/Chrysothamnus nauseosus

Symbol	%	
	100	Juniperus osteosperma/Pinus monophylla/Chrysothamnus viscidiflarus/Agropyron desertarum
	100	Juniperus osteosperma/Pinus monophylla/Quercus gambelii/Artemisia tridentata
	85	Pinus monophylla/Amelanchier pallida/Arctostophylas patula
	15	Artemisia tridentato/Chrysothamnus nauseosus
	100	Pinus monophylla/Amelanchier pallida/Quercus gambelii
	100	Pinus monophylla/Juniperus osteosperma/Artemisia nova/Amelanchier pallida
	75	Pinus monophylla/Juniperus osteosperma/Artemisia nova/Amelanchier pallida
	15	Quercus gambelii/Amelanchier pallida
	10	Artemisia tridentata/Chrysothamnus nauseosus
	70	Pinus ponderosa/Chrysothamnus nauseosus/Bromus tectorum
	25	Artemisia tridentata/Chrysothamnus nauseosus
	5	Chrysothamnus nauseosus/Artemisia tridentata
	65	Pinus ponderosa/Quercus gambelii
	35	Quercus gambelii/Amelanchier pallida
	70	Prunus fasciculata/Quercus turbinella/Bromus tectorum
	30	Artemisia tridentata/Lupinus caudatus

Prepared By W.H. Blackburn 1969, Renewable Resources Center, University Of Nevada; From Bureau Of Land Management Base Map.

Bureau of Land Management
Library
Bldg. 50, Denver Federal Center
Denver, CO 80225

U.S. DEPARTMENT
BUREAU OF LAN

BORROWE

S
87
.E4
R4
no.46

Vegetation and soi
Mathews Canyon W

DATE LOANED	BORROWER

(Continued on reverse)

Form